

CITY OF ARROYO GRANDE CLIMATE ACTION PLAN

*Adopted by City Council Resolution
November 26, 2013*



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City of Arroyo Grande

Climate Action Plan

Adopted by the City Council
November 26, 2013
Resolution 4557

Prepared for:



City of Arroyo Grande

Prepared by:



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Acronyms

AB	Assembly Bill
APCD	San Luis Obispo County Air Pollution Control District
Cal/EPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
CALGreen	California Green Building Standards Code
Caltrans	California Department of Transportation
CAFE	Corporate Average Fuel Economy
CAP	Climate Action Plan
CARB	California Air Resources Board
CEQA	California Environmental Quality Act
CH ₄	Methane
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
EPA	Environmental Protection Agency
GHG	Greenhouse gas
HFC	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt hours
LCFS	Low Carbon Fuel Standard
LED	Light-Emitting Diode
MPO	Metropolitan Planning Organization
MT	Metric tons
N ₂ O	Nitrous oxide
O ₃	Ozone
PFCs	Perfluorocarbons
PG&E	Pacific Gas and Electric
PV	Photovoltaic
RTA	Regional Transit Authority
SB	Senate Bill
SLOCOG	San Luis Obispo Council of Governments
TDM	Transportation demand management
VMT	Vehicle miles traveled

EXECUTIVE

SUMMARY

Executive Summary

The City of Arroyo Grande Climate Action Plan (CAP) is a long-range plan to reduce greenhouse gas (GHG) emissions from City government operations and community activities within Arroyo Grande and prepare for the anticipated effects of climate change. The CAP will also help achieve multiple community goals such as lowering energy costs, reducing air pollution, supporting local economic development, and improving public health and quality of life. Specifically this CAP is designed to:

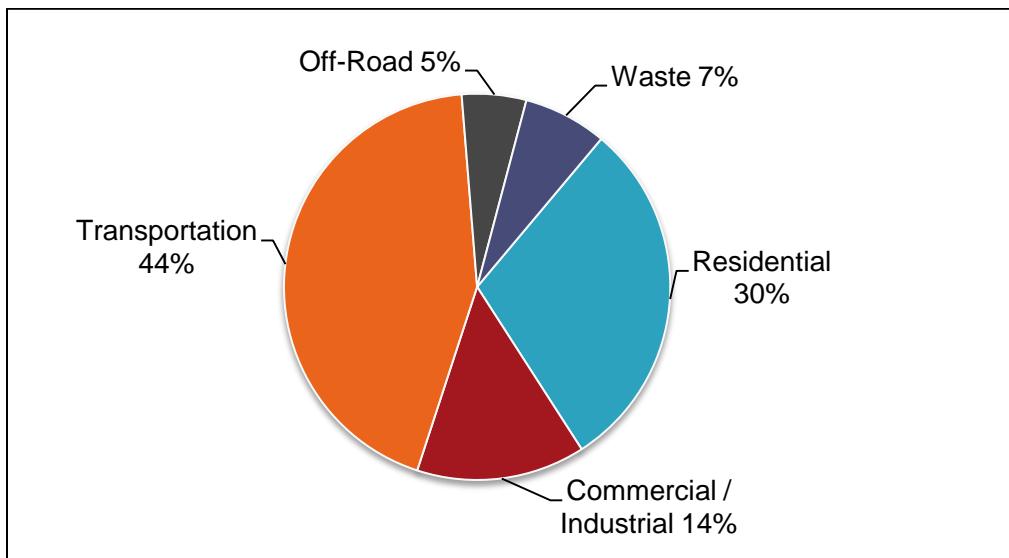
- Benchmark Arroyo Grande's 2005 baseline GHG emissions and 2020 projected emissions relative to the statewide GHG emissions target established under California Assembly Bill (AB) 32 of 1990 levels by 2020 (approximately 15 percent below 2005 levels by the year 2020).
- Provide a roadmap for achieving the city's GHG emissions reduction target of 15 percent below 2005 levels by the year 2020 and help Arroyo Grande prepare for anticipated climate change impacts.
- Serve as a qualified and comprehensive plan for addressing the cumulative impacts of GHG emissions within Arroyo Grande (see California Environmental Quality Act [CEQA] Guidelines, Section 15183.5, and the San Luis Obispo County Air Pollution Control District [APCD] CEQA Air Quality Handbook Sections 3.3 and 4.6).
- Support tiering and streamlining the analysis of GHG emissions for future projects within Arroyo Grande pursuant to State CEQA Guidelines Sections 15152 and 15183.5.

Arroyo Grande's GHG Emissions

The *City of Arroyo Grande 2005 Greenhouse Gas Emissions Inventory Update* (2012) (GHG Emissions Inventory) was prepared to identify the major sources and quantities of GHG emissions produced in Arroyo Grande in 2005 and forecast how these emissions may change over time. The GHG Emissions Inventory provides information on the scale of emissions from various sources and where the opportunities to reduce emissions lie. It also provides a baseline against which the City can measure its progress in reducing GHG emissions.

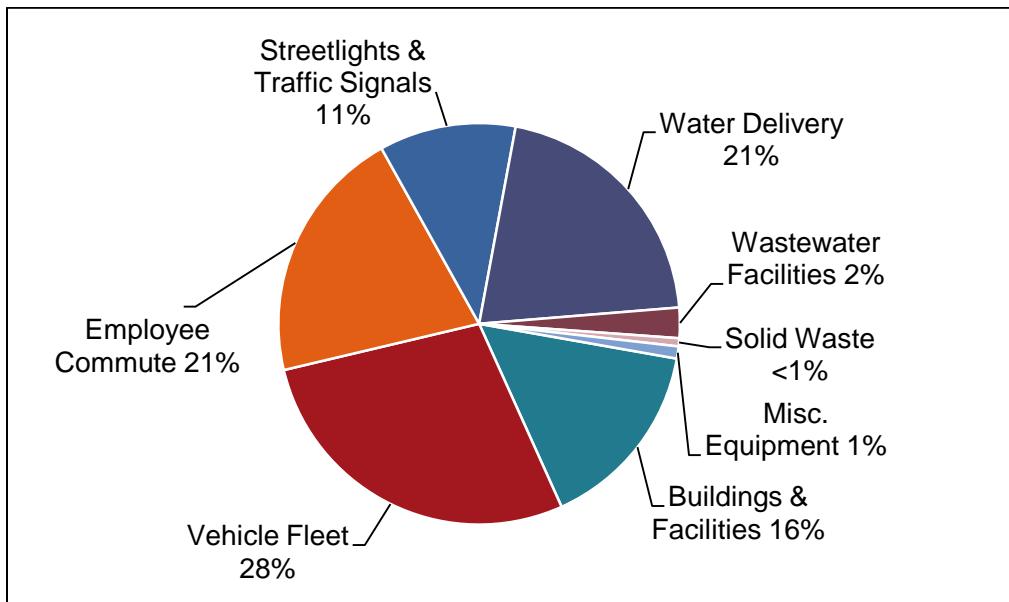
According to the GHG Emissions Inventory, in 2005, the Arroyo Grande community emitted approximately 84,399 metric tons of carbon dioxide equivalent GHG emissions (MT CO₂e), as a result of activities that took place within the transportation, residential energy use, commercial and industrial energy use, off-road vehicles and equipment, and solid waste sectors. As shown in **Figure ES-1**, the largest contributors of GHG emissions were the transportation (44 percent), residential energy use (30 percent) and commercial/industrial energy use (14 percent) sectors. The remainder of emissions resulted from the solid waste (seven percent) and off-road (five percent) sectors.

Figure ES-1: Community-wide GHG Emissions by Sector (2005)



The GHG Emissions Inventory also analyzed emissions from City government operations and facilities. The City government operations inventory is a subset of the community-wide inventory, and is included within the community-wide inventory. In 2005, City government operations generated approximately 1,227 MT CO₂e. This quantity represents approximately two percent of Arroyo Grande's total community-wide GHG emissions. As shown in **Figure ES-2**, these GHG emissions resulted from the City's vehicle fleet (28 percent), water delivery (21 percent), employee commutes (21 percent), building and facility energy use (16 percent), public lighting (street lights, traffic signal lights, and other outdoor public lighting) (11 percent), miscellaneous equipment (one percent), and solid waste (less than one percent).

Figure ES-2: City Government Operations GHG Emissions by Sector (2005)



The GHG emissions forecast is a projection of how GHG emissions will change in the future with projected changes in population and jobs.¹ The “business-as-usual scenario” provides a forecast of how GHG emissions will change in the year 2020 if consumption trends and behavior continue as they did in 2005, absent any new federal, state, regional, or local policies or actions that would reduce emissions. The year 2020 was selected for the forecast in order to maintain consistency with AB 32.

Under the business-as-usual scenario, Arroyo Grande’s GHG emissions are projected to grow approximately 11 percent above 2005 GHG emissions levels by the year 2020, from 84,399 MT CO₂e to 93,513 MT CO₂e. Emissions associated with the transportation and off-road sector will experience the highest level of growth (20 percent). Emissions for the other sectors will range from a 27 percent reduction to 13 percent increase. **Table ES-1** shows the forecast results of the business-as-usual scenario.

Table ES-1: 2020 Business-As-Usual GHG Emissions Forecast

Sector	2005 (MT CO ₂ e)	2020 (MT CO ₂ e)	Percent Change from 2005 to 2020
Transportation	36,897	44,361	20%
Commercial/Industrial	11,932	8,716	-27%
Residential	25,105	28,298	13%
Solid Waste	5,909	6,661	13%
Off-Road	4,556	5,477	20%
Total	84,399	93,513	11%

The *AB 32 Climate Change Scoping Plan* (2008) (AB 32 Scoping Plan), prepared by the California Air Resources Board (CARB) pursuant to AB 32, identifies several State measures that are approved, programmed, and/or adopted and would reduce GHG emissions within Arroyo Grande. These State measures require no additional local action. In addition to the State measures, the City of Arroyo Grande has implemented a number of local measures since the 2005 baseline inventory year that will reduce the community’s GHG emissions. Therefore, these measures were incorporated into the forecast and reduction assessment to create an “adjusted forecast scenario,” which provides a more accurate picture of future emissions growth and the responsibility of the City once State and local measures to reduce GHG emissions have been implemented.

As shown in **Table ES-2**, state and local measures will reduce GHG emissions in Arroyo Grande by an estimated 17,860 MT CO₂e by 2020. Under the adjusted forecast scenario GHG emissions are projected to decrease to 75,653 MT CO₂e (approximately 19 percent below the business-as-usual scenario of 93,513 MT CO₂e).

¹ Population and job projections for the year 2020 were obtained from the San Luis Obispo Council of Governments (SLOCOG) 2040 Population, Housing & Employment Forecast (August 2011) (see Chapter 2).

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Table ES-2: Summary of Reductions from State and Local Measures and 2020 GHG Emissions

State Measure	2020 Reduction (MT CO ₂ e)
2020 Business-as-Usual Forecast	93,513
2020 Reduction from State Measures	-16,940
2020 Reduction from Local Measures	-920
Total Reduction from State and Local Measures	-17,860
2020 Adjusted Forecast	75,653

GHG Emissions Reduction Target

The City is committed to reducing its GHG emissions by 15 percent below 2005 levels by 2020, consistent with AB 32. As shown in **Table ES-3**, based on the 15 percent reduction target Arroyo Grande would need to reduce its community-wide GHG emissions to 71,739 MT CO₂e by 2020. To meet this target, Arroyo Grande will need to reduce its GHG emissions 5 percent below the adjusted forecast level (equivalent to 3,914 MT CO₂e) by 2020 through implementation of local measures and actions.

Table ES-3: Arroyo Grande's GHG Emissions, Target, and Reduction Necessary to Meet Target

	GHG Emissions (MT CO ₂ e)
2005 Baseline Emissions	84,399
2020 Adjusted Forecast	75,653
Target (15% below 2005 levels by 2020)	71,739
Remaining Gap Necessary to Meet Target	3,914

Climate Action Measures

To achieve the State-recommended target of 15 percent below 2005 levels (71,739 MT CO₂e) by 2020 and prepare for the anticipated effects of climate change, the CAP identifies climate action measures. These measures are organized into the following focus areas: City government operations, energy, transportation and land use, off-road, solid waste, and tree planting. The measures were selected based on careful consideration of the emission reductions needed to achieve the target, the distribution of emissions in the GHG Emissions Inventory, existing priorities and resources, strategies of neighboring jurisdictions and regional agencies, and the potential costs and benefits of each measure. Collectively, the measures identified in the CAP have the potential to reduce GHG emissions within Arroyo Grande by 5,371 MT CO₂e (17 percent below the 2005 baseline) by 2020 and meet the reduction target.

Implementation and Monitoring

Implementation and monitoring are essential processes to ensure that Arroyo Grande reduces its GHG emissions and meets its target. To facilitate this, each climate action measure identifies implementation actions, departments responsible for implementation and monitoring, cost and savings estimates, the GHG reduction potential, a performance indicator to monitor progress, and an implementation time frame. Measure implementation is separated into three phases: near-term (by 2015), mid-term (2016-2017), and long-term (2018-2020).

In order to ensure that measures are implemented and their progress is monitored, upon adoption of the CAP, the City will establish a CAP Coordinator who will provide essential CAP oversight and coordination of a multi-departmental CAP Implementation Team comprised of key staff in each selected department. The CAP Implementation Team will meet at least one time per year to assess the status of CAP efforts. The City's CAP Coordinator will be responsible for developing an annual progress report to the City Council that identifies the implementation status of each measure, evaluates achievement of or progress toward performance indicators (where applicable), assesses the effectiveness of various measures and actions included in the CAP, and recommends adjustments to measures or actions, as needed. To evaluate the performance of the CAP as a whole, the City will update the community and City government operations GHG emissions inventories every five years, using the most up-to-date calculation methods, data, and tools.

CHAPTER 1

INTRODUCTION

1.0 Introduction

Although climate change is a global issue, the State of California recognizes that it poses risks to the public health, environment, economic well-being, and natural resources of California, and has taken an active approach to address climate change through the adoption of legislation and policies. In 2005, the governor issued Executive Order S-3-05 to reduce statewide GHG emissions to 1990 levels by 2020 (approximately 15 percent below 2005 levels) and to 80 percent below 1990 levels by 2050. Enactment of several related pieces of climate action legislation followed, including AB 32 (the Global Warming Solutions Act of 2006), which codified the 2020 target, and SB 97 (the CEQA and GHG Emissions bill of 2007), which requires lead agencies to analyze GHG emissions and mitigate climate change impacts under CEQA. These laws together create a framework for GHG emissions reductions and identify local governments as having a vital role to play in assisting the State in meeting these mandates. The AB 32 Scoping Plan, prepared by CARB pursuant to AB 32, notes that local governments have broad influence and, in some cases, exclusive authority over activities that result in GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and City government operations. In recognition of the important role local governments will play in the successful implementation of AB 32, the AB 32 Scoping Plan recommends a GHG emission reduction target for local governments of 15 percent below 2005 levels by 2020 to match the statewide reduction target and to mitigate their impacts on climate change.

Recognizing the important role and responsibility that local governments have in reducing GHG emissions and mitigating their potential climate change impacts, the City has prepared this CAP. This chapter describes the purpose, scope, and content of Arroyo Grande's CAP. This chapter also summarizes the scientific and regulatory framework under which this plan has been developed.

1.1 Purpose and Scope

The City's CAP is a long-range plan to reduce GHG emissions from community-wide activities and City government operations within Arroyo Grande to support the State's efforts under AB 32 and to mitigate the community's contribution to global climate change. Specifically, the CAP does the following:

- Summarizes the results of the *City of Arroyo Grande 2005 Greenhouse Gas Emissions Inventory Update*, which identifies the major sources and quantities of GHG emissions produced within Arroyo Grande and forecasts how these emissions may change over time.
- Identifies the quantity of GHG emissions that Arroyo Grande will need to reduce to meet its target of 15 percent below 2005 levels by the year 2020, consistent with AB 32.
- Sets forth City government and community-wide GHG reduction measures, including performance standards which, if implemented, would collectively achieve the specified emission reduction target.

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- Identifies proactive strategies that can be implemented to help Arroyo Grande prepare for anticipated climate change impacts.
- Sets forth procedures to implement, monitor, and verify the effectiveness of the CAP measures and adapt efforts moving forward as necessary.

In addition to reducing Arroyo Grande's GHG emissions consistent with AB 32 and mitigating the community's contribution to global climate change, implementation of the CAP will help achieve multiple community-wide goals, such as lowering energy costs, reducing air pollution, supporting local economic development, and improving public health and quality of life. The CAP may also be utilized to tier and streamline the analysis of GHG emissions of future development within Arroyo Grande pursuant to State CEQA Guidelines Sections 15152 and 15183.5 (refer to Section 1.4, *Relationship to CEQA*).

1.2 Content

The CAP is organized into the following chapters:

1.0 Introduction – describes the purpose, scope, and content of Arroyo Grande's CAP. It also summarizes the scientific and regulatory framework under which this plan has been developed.

2.0 GHG Emissions and Reduction Target – identifies the sources of GHG emissions in Arroyo Grande, quantifies emissions for a baseline year (2005), and forecasts how emission levels would change through 2020. This chapter also quantifies the GHG emissions reduction target for the year 2020.

3.0 Climate Action Measures – organizes the CAP measures into the following focus areas: City government operations, energy, transportation and land use, off-road, solid waste, and tree planting. Each GHG reduction measure is presented with implementation actions, estimated GHG reductions in 2020, and estimated cost and future savings.

4.0 Adaptation – includes a discussion of modeled climate change predictions, an urban system assessment, a vulnerability assessment, and adaptation measures to prepare for and minimize the risk associated with anticipated climate change impacts.

5.0 Implementation and Monitoring – sets forth procedures to implement and monitor the individual CAP measures, evaluate the CAP's performance, and amend the plan if it is not achieving targeted reduction levels. It also identifies potential sources of funding to implement the CAP.

1.3 Background and Planning Process

In 2007, the San Luis Obispo County Air Pollution Control District (APCD) convened a committee of agency stakeholders (Stakeholder Committee) from the cities of Atascadero, Arroyo Grande, Grover Beach, Morro Bay, Paso Robles, Pismo Beach, and San Luis Obispo and the County of San Luis Obispo to initiate a discussion on climate change, including science,

policy, funding, mitigation, adaptation, and public engagement. The APCD also coordinated the preparation of GHG emissions inventories for each of the jurisdictions. Both the City and County of San Luis Obispo received federal stimulus funds to support the development of their CAPs. San Luis Obispo County approved its EnergyWise Plan in November 2011, and the City of San Luis Obispo adopted its Climate Action Plan in July 2012. The APCD worked with the remaining six cities to secure funds for individual CAPs, including the City of Arroyo Grande CAP, through the Pacific Gas and Electric Company (PG&E) Green Communities Program, Southern California Gas Company (SoCalGas), and APCD's mitigation grant funding.

City staff and its consultants worked with members of the community and elected officials to develop the CAP. The public outreach program involved two community workshops that introduced the project gathered input and ideas for the document and on potential GHG reduction measures. A virtual town hall also provided an opportunity for community members to evaluate a preliminary set of GHG reduction measures and suggest additional ideas. Public outreach also included posting project information and updates to the project website (www.centralcoastghgplanning.com) and eNewsletter announcements. Public comment was also considered during Planning Commission and City Council meetings.

1.4 Relationship to CEQA

According to the California Natural Resources Agency (2009) and the State's Office of the Attorney General (2009), GHG emissions may be best analyzed and mitigated at the programmatic level (i.e., in a GHG reduction plan/CAP). In 2009, the California Natural Resources Agency amended the State CEQA Guidelines to add a new provision, Section 15183.5, which provides a framework for programmatic GHG emissions reduction plans (i.e., a CAP). Section 15183.5 states a plan for the reduction of GHG emissions should:

- Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
- Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable;
- Identify and analyze the GHG emissions resulting from sources in the community;
- Identify a suite of specific, enforceable measures that, collectively, will achieve the emissions target;
- Establish a mechanism to monitor the plan's progress and to require amendment if the plan is falling short; and
- Be adopted in a public process following environmental review.

This CAP was developed to be consistent with State CEQA Guidelines Section 15183.5. Once the CAP is adopted following environmental review, a lead agency may determine that projects that are consistent with the CAP will not have significant GHG-related impacts, thereby shortening the CEQA process, which can save time and money for these projects. **Appendix C** contains a worksheet that project applicants may use to demonstrate project-level compliance. If

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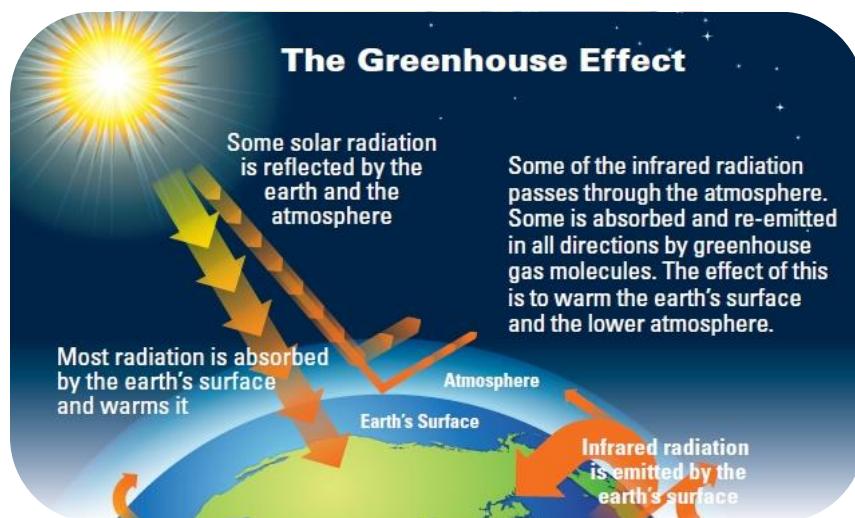
a project is found to be inconsistent with the CAP, the APCD thresholds discussed in Section 1.8.3 should be applied.

1.5 Scientific Background

In order to make meaningful and effective decisions regarding the mitigation of GHG emissions and adaptation to anticipated changes in climate, it is important to understand the science under which this CAP has been developed. This section provides a brief introduction to the scientific research efforts to understand how climate change occurs and its implications.

Global climate change refers to changes in the average climatic conditions on Earth as a whole, including changes in temperature, wind patterns, precipitation, and storms. Global warming, a related concept, is the observed increase in average temperature of the Earth's surface and atmosphere caused by increased GHG emissions, which can contribute to changes in global climate patterns. GHGs, such as water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and ozone (O₃), are gases in the Earth's atmosphere that play a critical role in determining the Earth's surface temperature. Specifically, GHGs allow high-frequency solar radiation to enter the Earth's atmosphere, but trap the low frequency, long wave energy which is radiated back from the Earth to space, resulting in a warming of the atmosphere. The trapping of heat at the Earth's surface is known as the "greenhouse effect" (refer to **Figure 1-1**).

Figure 1-1: The Greenhouse Effect

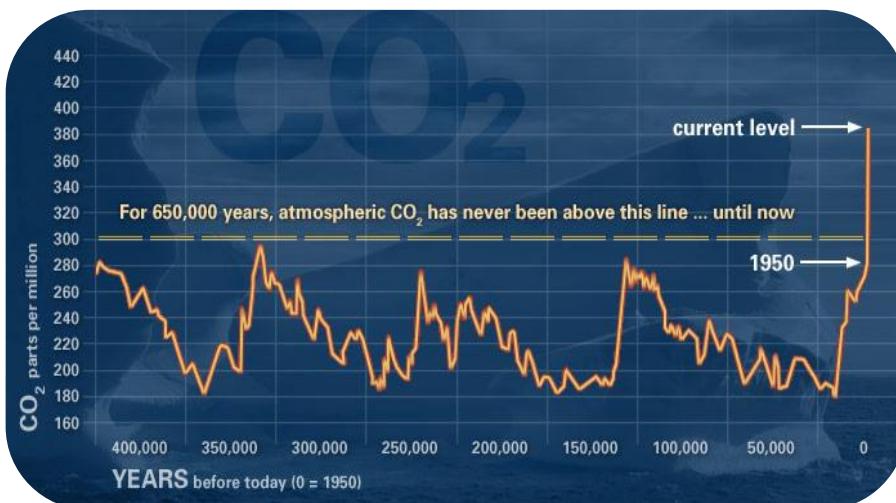


Source: National Oceanic & Atmospheric Administration (NOAA), 2009

GHGs are the result of both natural and anthropogenic activities. The consumption of fossil fuels for power generation and transportation, forest fires, decomposition of organic waste, and industrial processes are the primary sources of GHG emissions. Without human intervention, the Earth maintains an approximate long-term balance between the emission of GHGs into the atmosphere and its storage in oceans and terrestrial ecosystems. Following the industrial revolution, however, increased combustion of fossil fuels (e.g., gasoline, diesel, coal, etc.) and

other industrial processes have contributed to the rapid increase in atmospheric levels of GHGs (refer to **Figure 1-2**) (NOAA, 2009). This increase in GHGs correlates with the recent increase in global average temperature (which has risen approximately 1.4°F since the early 20th century) (IPCC, 2007; NOAA, 2009).

Figure 1-2: Historic Fluctuations and Recent Increases in Atmospheric Carbon Dioxide



This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO₂ has increased since the Industrial Revolution (NASA, 2011).

The principal GHGs that enter the atmosphere as a result of human activities are discussed below.

- **Carbon dioxide (CO₂)** is released into the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., cement production) and deforestation. Carbon dioxide is also removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle.
- **Methane (CH₄)** is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from agricultural practices, such as the raising of livestock, and by the decomposition of organic waste in landfills.
- **Nitrous oxide (N₂O)** is emitted during agricultural and industrial activities, as well as during the burning of fossil fuels and solid waste.
- **Fluorinated gases** (i.e., hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) are synthetic GHGs that are emitted from a variety of industrial processes (e.g., aluminum production) and used in commercial, industrial, and consumer products (e.g., automobile air conditioners and refrigerants). These gases are typically emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as “high global warming potential” gases.

1.0 INTRODUCTION

Each GHG has a different potential for trapping heat in the atmosphere, called global warming potential. For example, one pound of methane has 21 times more heat capturing potential than one pound of carbon dioxide. To simplify reporting and analysis of GHGs, GHG emissions are typically reported in metric tons of carbon dioxide equivalent units (or MT CO₂e). When dealing with an array of emissions, the gases are converted to their carbon dioxide equivalents for comparison purposes. The global warming potentials for common GHGs are shown in **Table 1-1**.

Table 1-1: Global Warming Potential of GHGs

GHG	Global Warming Potential
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	21
Nitrous Oxide (N ₂ O)	310
Hydrofluorocarbons (HFCs)	140-11,700
Perfluorocarbons (PFCs)	6,500-9,200
Sulfur Hexafluoride (SF ₆)	23,900

Notes: Each of the GHGs listed above differs in its ability to absorb heat in the atmosphere, or in its global warming potential. The values presented above are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report and United Nations Framework Convention on Climate Change reporting guidelines (IPCC, 1996). Although the IPCC Fourth Assessment Report presents different estimates, the current inventory standard relies on the Second Assessment Report's intensity factors to comply with reporting standards and consistency with regional and national inventories (USEPA, 2010).

1.6 Climate Change Impacts

Increases in the globally averaged atmospheric concentration of GHGs will cause the lower atmosphere to warm, in turn inducing a myriad of changes to the global climate system. These large-scale changes will have unique and potentially severe impacts in the western United States, California, and the central coast region. Current research efforts coordinated through CARB, California Energy Commission, California Environmental Protection Agency (EPA), University of California system, and other entities are examining the specific changes to California's climate that will occur as the Earth's surface warms.

The best available climate models indicate that climate change could impact the natural environment in California in the following ways, among others (California Natural Resources Agency, 2009):

- Rising sea levels along the California coastline caused by ocean expansion and glacier melt



- Extreme-heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent
- An increase in heat-related human deaths, infectious diseases, and a higher risk of respiratory problems caused by deteriorating air quality
- Reduced snow pack and stream flow in the Sierra Nevada Mountains, affecting winter recreation and water supplies
- Potential increase in the severity and historical pattern of winter storms, affecting peak stream flows and flooding
- Changes in growing season conditions that could affect California agriculture, causing variations in crop quality and yield
- Changes in distribution of plant and wildlife species brought about by changes in temperature, competition from colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects

1.7 Implications for Arroyo Grande

Rising temperatures affect local and global climate patterns, and these changes are forecasted to manifest themselves in a number of ways that may impact the central coast region. As further discussed in Chapter 4, *Adaptation*, according *ClimateWise: Integrated Climate Change Adaptation Planning in San Luis Obispo County* (ClimateWise, 2010) potential climate changes that could occur in Arroyo Grande by the end of this century include:

- Increased temperatures
- Changed precipitation
- Increased frequency and severity of storm events
- Increased burn area from wildfires

1.8 Regulatory Background

This section summarizes the federal, state, and regional legislation, regulations, policies, and plans that have guided the preparation and development of this CAP.

1.8.1 FEDERAL

Clean Air Act. The U.S. EPA is the federal agency responsible for implementing the Clean Air Act. The U.S. Supreme Court ruled in its decision in *Massachusetts et al. v. Environmental Protection Agency et al.*, issued on April 2, 2007, that carbon dioxide is an air pollutant as defined under the Clean Air Act and that the U.S. EPA has the authority to regulate emissions of GHGs as pollutants. In 2011, the U.S. EPA began regulating GHG emissions from new power plants and refineries through a set of New Source Performance Standards. These regulations are found in 40 CFR Part 60 and apply to new, modified and reconstructed affected facilities in

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specific source categories such as manufacturers of glass, cement, rubber tires and wool fiberglass.

Energy Independence and Security Act. The Energy Independence and Security Act of 2007 includes several provisions that will increase energy efficiency and the availability of renewable energy, which in turn will reduce GHG emissions. First, the Act sets a Renewable Fuel Standard that requires fuel producers to use at least 36 billion gallons of biofuel by 2022. Second, it increased Corporate Average Fuel Economy (CAFE) Standards to require a minimum average fuel economy of 35 miles per gallon for the combined fleet of cars and light trucks by 2020. Third, it includes a variety of new standards for lighting and for residential and commercial appliance equipment, including residential refrigerators, freezers, refrigerator-freezers, metal halide lamps, and commercial walk-in coolers and freezers.

1.8.2 STATE OF CALIFORNIA

The State of California has been proactive in working to reduce emissions and has a long history of leadership in addressing energy and climate issues spanning the last 40 years. In 1988, AB 4420 (Sher, Chapter 1506, Statutes of 1988) designated the California Energy Commission as the lead agency for climate change issues in California. Since that time, numerous initiatives in California have addressed climate change and energy efficiency, the majority of legislation passed since 2000. These initiatives have strengthened the ability of entities in California to engage in accurate data collection and have created targets and regulations that will directly lead to reductions in GHG emissions. These initiatives are described below.

Executive Order S-3-05. Executive Order S-3-05, issued in 2005, was the first comprehensive state policy to address climate change. It established ambitious GHG reduction targets for the State: reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020 and to 80 percent below 1990 levels by 2050. This Executive Order is binding only for State agencies and has no force of law for local governments. However, S-3-05 is important for two reasons. First, it obligated State agencies to implement GHG emission reduction strategies. Second, the signing of the Order sent a clear signal to the Legislature about the framework and content for legislation to reduce GHG emissions as a necessary step toward climate stabilization.

Assembly Bill 32 (California Global Warming Solutions Act of 2006). AB 32 codified the State's 2020 GHG emissions target by directing CARB to reduce California's statewide emissions to 1990 levels by 2020. AB 32 also required CARB to develop a policy plan for reaching the 2020 emissions target and to adopt and enforce regulations to implement the plan. The resulting AB 32 Scoping Plan was adopted by CARB in December 2008. Key elements of the plan for achieving the 2020 target include:

- Adopting and implementing measures pursuant to existing state laws and policies, including California's goods movement measures and the Low Carbon Fuel Standard
- Expanding energy efficiency programs and green building practices
- Reducing methane emissions at landfills

- Developing a California cap-and-trade program
- Establishing and seeking to achieve reduction targets for transportation-related GHG emissions
- Increasing waste diversion, composting, and commercial recycling toward zero-waste
- Strengthening water efficiency programs
- Preserving forests that sequester carbon dioxide

Although the AB 32 Scoping Plan does not identify specific reductions for local governments, it identifies overall reductions from local government operations and land use decisions as a strategy to meet the 2020 target. The AB 32 Scoping Plan states that land use planning and urban growth decisions will play an important role in the State's GHG reductions because local governments have primary authority to plan, zone, approve, and permit how land is developed to accommodate population growth and the changing needs of their jurisdictions. It further acknowledges that decisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas emission sectors. However, the AB 32 Scoping Plan stopped short of identifying mandatory targets for local government compliance. Instead, it encourages local governments to adopt a target for City government and community-wide emissions that parallels the State's AB 32 target and reduces emissions by approximately 15 percent by 2020.

Senate Bill 97. SB 97 (2007) established that GHG emissions and the effects of GHG emissions are appropriate subjects for CEQA analysis and required the Governor's Office of Planning and Research to develop guidelines to analyze GHG impacts under CEQA. The guidelines were adopted on December 31, 2009, requiring lead agencies to analyze GHG emissions and the effects of GHG emissions during CEQA review.

Assembly Bill 1493 (Pavley Regulations). AB 1493 (referred to as Pavley I) (2002) directed CARB to develop and adopt standards for vehicle manufacturers to reduce GHG emissions coming from passenger vehicles and light-duty trucks at a "maximum feasible and cost effective reduction" by January 1, 2005. Pavley I took effect for model years starting in 2009 to 2016 and Pavley II will cover 2017 to 2025. Fleet average emission standards would reach 22 percent reduction by 2012 and 30 percent by 2016.

Executive Order S-1-07 (Low Carbon Fuel Standard). This 2007 order requires fuel providers to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020.

Senate Bill 375. SB 375 (2008) supports implementation of AB 32 by aligning regional transportation planning efforts with land use and housing allocations in order to reduce transportation-related GHG emissions. Specifically, SB 375 directed CARB to set regional GHG emissions targets for passenger vehicles and light trucks for the years 2020 and 2035 for each Metropolitan Planning Organization (MPO) region, which were adopted in February 2011. The San Luis Obispo Council of Governments (SLOCOG), Arroyo Grande's MPO, has adopted reduction targets for per capita emissions from passenger vehicles of 8 percent below baseline (2005) for the years 2020 and 2035 (CARB, 2011). These targets apply to the SLOCOG region

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as a whole, and not to individual cities or sub-regions. In 2008, GHG emissions from passenger vehicles in the San Luis Obispo region were approximately 16.5 pounds CO₂e per capita. Therefore, SLOCOG must reduce emissions to at least 15.18 pounds CO₂e per capita by 2020 and maintain or further reduce that level through 2035 to meet the target. SLOCOG's 2010 Regional Transportation Plan and Preliminary Sustainable Communities Strategy (RTP-PSCS), adopted in 2010, details how the region will meet the target (refer to the discussion of SLOCOG's 2010 RTP-PSCS in Section 1.8.3 below).

Senate Bill 1078, Senate Bill 107, and Senate Bill 2X (Renewables Portfolio Standard).

Established in 2002 under SB 1078, and accelerated in 2006 under SB 107, California's Renewables Portfolio Standard required investor-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources by at least 1 percent of their retail sales annually, until they achieved 20 percent by 2010. SB 2X raises the target from the current 20 percent, requiring private and public utilities to obtain 33 percent of their electricity from renewable energy sources by 2020.

Senate Bill 1368. SB 1368 (2006) directs the California Energy Commission and the California Public Utilities Commission to adopt a performance standard for GHG emissions for the future electricity used in California, regardless of whether it is generated in-state or purchased from other states.

Assembly Bill 811. AB 811 (2008) authorizes California cities and counties to designate districts within which willing property owners may enter into contractual assessments to finance the installation of renewable energy generation and energy efficiency improvements that are permanently fixed to the property. These financing arrangements would allow property owners to finance renewable energy generation and energy efficiency improvements through low-interest loans that would be repaid as an item on the property owner's property tax bill.

California Green Building Code. The California Green Building Code (2008) (the CALGreen Code) is the statewide green building code, which was developed to provide a consistent approach for green building within California. It lays out minimum requirements for newly constructed buildings in California, which will reduce GHG emissions through improved efficiency and process improvements. It requires builders to install plumbing that cuts indoor water use by as much as 20 percent, divert 50 percent of construction waste from landfills to recycling, and use low-pollutant paints, carpets, and floors.

California Code of Regulations Title 24, Part 6. Although it was not originally intended specifically to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated periodically to allow consideration and possible incorporation of new energy-efficient technologies and methods. The California Energy Commission estimates that the 2008 standards reduce consumption by 10 percent for residential buildings and 5 percent for commercial buildings, relative to the previous standards. For projects implemented after January 1, 2014, the California Energy Commission estimates that the 2013 Title 24 energy

efficiency standards will reduce consumption by 25 percent for residential buildings and 30 percent for commercial buildings, relative to the 2008 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not include other appliances, outdoor lighting that is not attached to buildings, plug loads, or other energy uses.

Assembly Bill 341. AB 341 (2011) establishes a new policy goal of the State of California to divert at least 75 percent of solid waste generated by the year 2020 in an effort to reduce GHG emissions. It also provides for mandatory commercial and multi-family residential recycling, and requires cities and counties to add a commercial and multi-family residential recycling element to their existing resource reduction plans.

1.8.3 REGIONAL

SAN LUIS OBISPO COUNTY AIR POLLUTION CONTROL DISTRICT

The APCD has primary responsibility for the development and implementation of rules and regulations designed to attain the National Ambient Air Quality Standards and California Ambient Air Quality Standards, as well as the permitting of new or modified sources, development of air quality management plans, and adoption and enforcement of air pollution regulations within San Luis Obispo County, which is located within the South Central Coast Air Basin. The APCD regulates most air pollutant sources, except for mobile sources, which are regulated by CARB or California EPA. State and local government projects, as well as projects proposed by the private sector, are subject to APCD requirements if the sources are regulated by the APCD.

The AB 32 Scoping Plan does not provide an explicit role for local air districts in implementing AB 32, but it does state that CARB will work actively with air districts in coordinating emissions reporting, encouraging and coordinating GHG reductions, and providing technical assistance in quantifying reductions. The ability of air districts to control emissions (both criteria pollutants and GHGs) is provided primarily through permitting as well as through their role as CEQA lead or commenting agency, the establishment of CEQA thresholds, and the development of analytical guidance for CEQA documents.

In March 2012, the APCD adopted GHG thresholds in order to help lead agencies meet the GHG reduction goals of AB 32. The APCD's approach to developing a threshold of significance for GHG emissions was to identify the GHG emissions level for which a project would not be expected to substantially conflict with existing California legislation adopted to reduce statewide GHG emissions. Different thresholds were developed to accommodate various development types and patterns and are summarized below in **Table 1-2**.

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Table 1-2: APCD GHG Significance Thresholds

GHG Emission Source Category	Operational Emissions
Residential and Commercial Projects	Compliance with Qualified GHG Reduction Strategy OR Bright-Line Threshold of 1,150 MT CO ₂ e/yr OR Efficiency Threshold of 4.9 MT CO ₂ e/SP*/yr
(Industrial) Stationary Sources	10,000 MT of CO ₂ e/yr

*SP = Service Population (residents + employees). YR = Year

For projects other than stationary sources, compliance with either a Qualified GHG Reduction Strategy, or with the Bright-Line (1,150 CO₂e/yr) or Efficiency Threshold (4.9 MT CO₂e/SP/yr) would result in an insignificant determination, and in compliance with the goals of AB 32. The construction emissions of projects will be amortized over the life of a project and added to the operational emissions. Emissions from construction-only projects (e.g. roadways, pipelines, etc.) will be amortized over the life of the project and compared to an adopted GHG Reduction Strategy or the Bright-Line Threshold only.

The APCD recommends that lead agencies within the county use the adopted GHG thresholds of significance when considering the significance of GHG impacts of new projects subject to CEQA. Further, projects with GHG emissions that exceed the thresholds will need to implement mitigation to reduce the impacts to a less than significant level, which can be accomplished through a Mitigated Negative Declaration or an Environmental Impact Report.

As identified in the APCD thresholds, if a project is consistent with an adopted Qualified GHG Reduction Strategy (e.g., CAP meeting criteria identified in Section 1.4 above) that addresses the project's GHG emissions, it can be presumed that the project will not have significant GHG emission impacts. This approach is consistent with CEQA Guidelines Section.5.

As discussed in Section 1.4 above, this CAP was developed to be consistent with CEQA Guidelines Section 15183.5 to mitigate emissions and climate change impacts and will therefore serve as a Qualified GHG Reduction Strategy for the City of Arroyo Grande.

SAN LUIS OBISPO COUNCIL OF GOVERNMENTS

SLOCOG is the local Council of Governments with responsibility for regional planning for San Luis Obispo County. SLOCOG's planning efforts address regional issues relating to transportation, land use and urban form, housing, environment, economic development, regional public facilities, and climate change. Plans that SLOCOG has adopted that support GHG emissions reductions in Arroyo Grande are described below.

Rideshare Program. The Rideshare Program is a division of SLOCOG that focuses on outreach and events to promote bicycling, walking, carpooling, vanpooling, and riding the bus. Some of the major programs include:

- Bike month and Rideshare month.

- Transportation Choices Program – This is a free program in San Luis Obispo County offered to businesses and organizations that encourage their employees to use sustainable transportation. The goal of the Transportation Choices Program is to equip employers with the tools needed to promote positive change in employee commuting habits.
- Mobility Management Program - The goal of the program is to bridge the communications gap between Public Transit Operators and Social Services Agencies.
- Safe Routes to School Program - Safe Routes to School is a national and international movement to enable and encourage students to walk and bicycle to school. Through the use of education, encouragement, enforcement, engineering and evaluation, programs and projects are being developed to create a safe, healthy and fun environment for walking and biking to school.
- Senior Transportation Choices Program - Rideshare works hand-in-hand with seniors throughout the county, providing tools and education on how to use public transportation and community transportation services. Through our Senior Transportation Choices Program, we provide transportation information, Transit Field Trips and personalized trip planning.

Planning for Alternative Modes. SLOCOG focuses planning efforts to support the use of the following alternative modes of transportation:

- **Bikes** – SLOCOG supports and promotes bicycling as a viable transportation choice. SLOCOG staff attend Bicycle Advisory Committees in the City of San Luis Obispo and San Luis Obispo County. SLOCOG staff also review and advise jurisdictions on approval of BTA eligible Bicycle Plans.
- **Pedestrians** – SLOCOG is in the process of developing the Northern San Luis Obispo County Salinas River Corridor Anza Trail Master Plan.
- **Bus** – SLOCOG works with all transit providers to coordinate services. The Transit Operators Group is an Ad Hoc committee of transit operators, contractors, and SLOCOG staff. Coordinating projects include the Coordinated Human Services Public Transportation Plan, the Region Wide Fare Improvement Study, and the Long Range Transit Plan.
- **Rail** – SLOCOG coordinates and prepares agendas for the Coast Rail Coordinating Council (CRCC). The purpose of the CRCC is to improve the frequency and speed of passenger trains on the coast route between San Francisco and Los Angeles.

Community 2050 Regional Blueprint. Community 2050 is a collaborative planning effort that utilizes scenario planning to study long-range regional growth. Community 2050 outlines a program to improve multimodal mobility through a combination of strategies and investments to accommodate growth in transportation demand and reduce congestion that will contribute to a strong economy.

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2010 Regional Transportation Plan – Preliminary Sustainable Communities Strategy (RTP-PSCS). The RTP-PSCS, most recently updated in 2010, is a comprehensive plan guiding transportation policy for the region and makes recommendations concerning improvements to the existing transportation network of highways, transit, air, water, rail and bicycling. The plan helps position the region to achieve smarter, more sustainable growth that meets the transportation needs of the growing population and changing region. The primary purpose of the RTP-SCS is to integrate sustainable communities strategies developed under the Community 2050 Regional Blueprint and continue progress in accomplishing the intermodal mix of policies, programs and projects in the adopted RTP, Vision 2025, adopted in 2005. The 2010 RTP-PSCS contains a “Preliminary” Sustainable Communities Strategy consistent with the purpose and intent of state bills related to GHG emissions GHGs and climate change, including AB 32 and the SB 375.

2012 SCS-compliant RTP Update. SLOCOG is currently working to prepare a 2012 SCS-compliant RTP. This update will build upon and further refine the efforts of the 2010 RTP-PSCS to adjust alternatives to satisfy State requirements of SB 375. SLOCOG must reduce per capita GHG emissions from passenger vehicles by 8 percent relative to 2005 levels in 2020 and 2030.

LOCAL GOVERNMENT ROLES AND RESPONSIBILITIES

The AB 32 Scoping Plan establishes a framework for achieving statewide GHG reductions required by AB 32. Specifically, the AB 32 Scoping Plan describes a list of measures that the State will undertake, and the anticipated GHG reductions associated by these measures, by 2020. Because the State does not have jurisdictional control over all of the activities that produce GHG emissions in California, the AB 32 Scoping Plan articulates a unique role for local governments in helping to achieve the statewide GHG reduction target, noting their broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and City government operations. As such the AB 32 Scoping Plan recommends that local governments reduce GHG emissions from both their City government operations and community at large.

CHAPTER 2

GHG EMISSIONS AND REDUCTION TARGET

2.0 GHG Emissions and Reduction Target

A GHG emissions inventory identifies the major sources and quantities of GHG emissions produced by community-wide activities and City government facilities and operations within a jurisdiction's boundaries for a given year. Estimating GHG emissions enables local governments to establish an emissions baseline, track emissions trends, identify the greatest sources of GHG emissions within their jurisdiction, set targets for future reductions, and create an informed mitigation strategy based on this information.

This chapter summarizes the results of the GHG Emissions Inventory (2012). The GHG Emissions Inventory includes a 2005 baseline inventory of GHG emissions resulting from community-wide activities and City government facilities and operations within Arroyo Grande. It also includes a 2020 business-as-usual forecast of how emissions would change over time as a result of population and job growth if consumption trends and efficiencies remained at their 2005 levels, absent of any new policies or actions that would reduce emissions. Since 2005, there have been several State regulations and local initiatives that have been implemented that will reduce Arroyo Grande's GHG emissions. Therefore, this chapter also presents a 2020 adjusted forecast to account for the impact of these measures to provide a more accurate picture of future emissions growth in 2020. In addition, this chapter identifies the City's GHG emissions reduction target for the year 2020 consistent with AB 32. **Appendix A** contains the complete GHG Emissions Inventory and supporting documentation.

2.1 2005 Baseline GHG Emissions

This section summarizes the methodology used to complete the 2005 baseline inventory of community-wide activities and City government facilities and operations, and the results.

2.1.1 METHODOLOGY

The 2005 baseline inventory quantifies the amount of GHG emissions that occurred within the City's jurisdictional boundary in the year 2005. It includes a community-wide inventory that details the sources and quantities of GHG emissions resulting from activities from the Arroyo Grande community as a whole, and a City government operations inventory that identifies the sources and quantities of emissions resulting from the City of Arroyo Grande's operations and facilities. The City government operations inventory is a subset of the community-wide inventory, such that the City government's emissions are included within the community-wide inventory.

The community-wide inventory is divided into the following sectors, or categories of emissions sources: residential energy use, commercial and industrial energy use, transportation, off-road vehicles and equipment, and solid waste. The City government operations inventory provides a more detailed analysis of emissions resulting from City-owned or -operated buildings and

2.0 GHG EMISSIONS AND REDUCTION TARGET

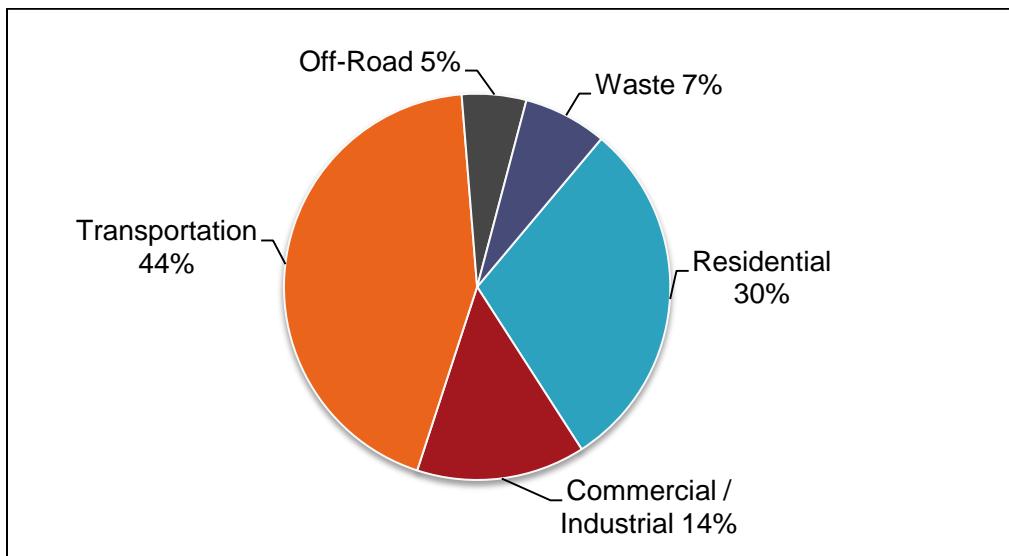
facilities, fleet vehicles, and streetlights and traffic signals; water delivery; wastewater; solid waste; employee commute travel; and other miscellaneous equipment.

The City government operations inventory follows the *Local Government Operations Protocol* (version 1.1), which was adopted in 2010 by CARB and serves as the national standard for quantifying and reporting GHG emissions from local government operations. The community-wide inventory follows the *Association of Environmental Professionals (AEP) California Community-wide GHG Baseline Inventory Protocol (AEP Protocol)* (June 2011) and *ICLEI International Local Government GHG Emissions Analysis Protocol (IEAP)* (October 2009). These protocols provide standard accounting principles, boundaries, quantification methods, and procedures for reporting GHG emissions. Like all emissions inventories, this inventory must rely on the best-available data and calculation methodologies at the time of preparation, and therefore, represents a best estimate of GHG emissions following standard methodologies. As protocols are updated, as better data and calculation methodologies become available, the inventory can be updated and improved. Nevertheless, the findings of this analysis provide a solid basis upon which Arroyo Grande is planning and taking action to reduce its GHG emissions.

2.1.2 COMMUNITY-WIDE GHG EMISSIONS

In 2005, the Arroyo Grande community emitted approximately 84,399 MT CO₂e as a result of activities that took place within the residential energy use, commercial and industrial energy use, transportation, off-road, and solid waste sectors. As shown in **Figure 2-1** and **Table 2-1**, the transportation sector was the largest contributor of GHG emissions, generating approximately 36,897 MT CO₂e, or 44 percent of total 2005 emissions. Transportation sector emissions are the result of diesel and gasoline fuel used in on-road vehicles traveling to and/or from locations within Arroyo Grande.¹ Electricity and natural gas consumption within the residential sector was the second largest contributor, generating 25,105 MT CO₂e, or 30 percent of the total emissions. Electricity and natural gas consumption in Arroyo Grande's commercial and industrial sector produced 11,932 MT CO₂e, or 14 percent of total community-wide emissions. Emissions from solid waste sent to landfills (5,909 MT CO₂e, or seven percent) and off-road vehicles and equipment (4,556 MT CO₂e, or five percent) accounted for the remainder of community-wide emissions.

¹ Excludes pass-through trips that do not have an origin or destination within the city. Emissions take into account the regional mix of vehicle classes and model years, as well as ambient conditions and travel speeds that determine fuel efficiency. Types of emissions accounted for include: running exhaust, idle exhaust, starting exhaust, diurnal, resting loss, running loss, and hot soak. Refer to **Appendix A** for further information.

Figure 2-1: Community-wide GHG Emissions by Sector (2005)**Table 2-1: Community-wide GHG Emissions by Sector (2005)**

Sector	Description	GHG Emissions (MT CO ₂ e)	Percent of Total
Residential	Electricity and natural gas used in homes	25,105	30%
Commercial/Industrial	Electricity and natural gas used in commercial and industrial buildings	11,932	14%
Transportation	Gasoline and diesel used in on-road vehicles	36,897	44%
Off-Road Vehicles and Equipment	Gasoline, diesel, and compressed natural gas used in off-road vehicles and equipment	4,556	5%
Solid Waste	Methane from the decomposition of landfilled solid waste	5,909	7%
Total		84,399	100%

2.1.3 CITY GOVERNMENT OPERATIONS GHG EMISSIONS

In 2005, City government operations generated approximately 1,227 MT CO₂e. This quantity represents approximately two percent of Arroyo Grande's total community-wide GHG emissions. As shown in **Figure 2-2** and **Table 2-2**, fuel consumption from the City's fleet vehicles and water delivery were the largest contributors to the City's emissions (generating approximately 28 percent and 21 percent of total emissions, respectively). Emissions from employee commute (21 percent) and electricity and natural gas used at City buildings (16 percent) were also a significant source of emissions, as were emissions from electricity used for streetlights and traffic signals (11 percent). Emissions from wastewater facilities (two percent), other miscellaneous equipment (one percent) and solid waste (less than one percent) accounted for the remainder of the City's emissions.

2.0 GHG EMISSIONS AND REDUCTION TARGET

Figure 2-2: City Government GHG Emissions by Sector (2005)

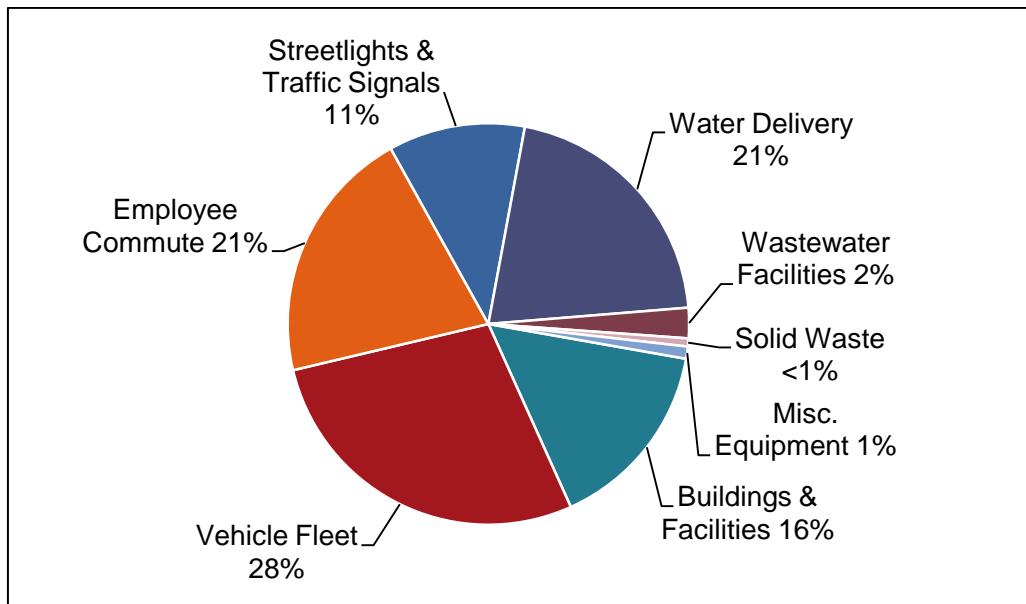


Table 2-2: City Government GHG Emissions by Sector (2005)

Sector	Description	GHG Emissions (MT CO ₂ e)	Percent of Total
Vehicle Fleet	Diesel and gasoline consumption and vehicle type	344	28%
Employee Commute	Annual vehicle miles travelled (VMT) from sample of employee commuting patterns	253	21%
Buildings and Facilities	Electricity and natural gas consumption in City-owned or – operated buildings and facilities	190	16%
Streetlights & Traffic Signals	Electricity used to power streetlights, traffic signal lights, and other public outdoor lighting	135	11%
Solid Waste	Annual waste tonnage sent to landfill	8	<1%
Water Delivery	Electricity used for water transport resulting from City operations	255	21%
Wastewater Facilities	Electricity consumption from wastewater facilities	30	2%
Other – Misc. Equipment	Fuel consumption by equipment type	12	1%
Total		1,227	100%

2.2 2020 GHG Emissions Forecast

2.2.1 METHODOLOGY

The GHG emissions forecast provides a “business-as-usual estimate,” or scenario, of how emissions will change in the year 2020 if consumption trends and behavior continue as they did in 2005, absent any new federal, state, regional, or local policies or actions that would reduce emissions. The year 2020 was selected for the forecast in order to maintain consistency with AB 32.

The GHG emissions forecast is based on projected growth trends in population, jobs, and VMT and the assumption that the emissions per sector will change over time in proportion to population, jobs, and VMT. The forecast relies on the San Luis Obispo Council of Governments’ (SLOCOG) *San Luis Obispo County 2040 Population, Housing & Employment Forecast* (August 2011) for year 2020 population and job projections and VMT estimates from SLOCOG’s regional travel demand model for the year 2020 were provided by Fehr & Peers. The “mid-range” cases for population and job growth were used for this forecast.

2.2.2 2020 BUSINESS-AS-USUAL FORECAST

Under a business-as-usual scenario, Arroyo Grande’s GHG emissions are projected to grow by approximately 11 percent by the year 2020, from 84,399 MT CO₂e to 93,513 MT CO₂e. Emissions associated with the transportation and off-road sectors are projected to experience the highest level of growth (20 percent). **Table 2-3** and **Figure 2-3** show the results of the forecast.

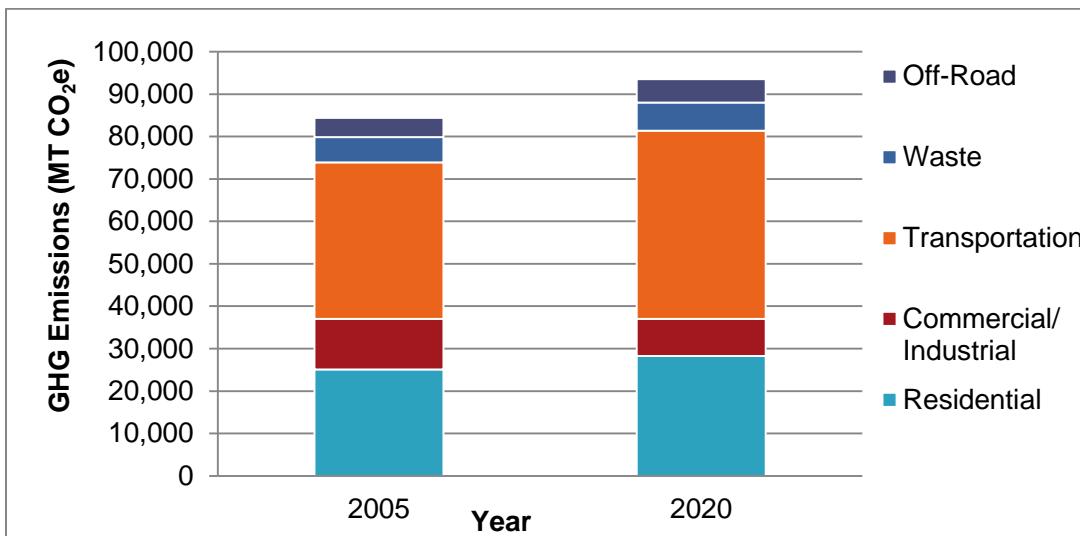
Table 2-3: 2020 Business-As-Usual GHG Emissions Forecast

Sector	2005 (MT CO ₂ e)*	2020 (MT CO ₂ e)*	Percent Change from 2005 to 2020
Residential	25,105	28,298	13%
Commercial / Industrial	11,932	8,716	-27%
Transportation	36,897	44,361	20%
Off-Road	4,556	5,477	20%
Solid Waste	5,909	6,661	13%
Total	84,399	93,513	11%

*Refer to **Appendix A** for details

2.0 GHG EMISSIONS AND REDUCTION TARGET

Figure 2-3: 2020 Business-As-Usual GHG Emissions Forecast



2.2.3 2020 ADJUSTED FORECAST

A. INCORPORATION OF STATE REDUCTIONS INTO FORECAST

The AB 32 Scoping Plan identifies several State measures that are approved, programmed, and/or adopted and will reduce GHG emissions within Arroyo Grande. These State measures require no additional local action. Therefore, these measures were incorporated into the forecast and reduction assessment to create an “adjusted forecast,” which provides a more accurate picture of future emissions growth and the responsibility of the City once State measures to reduce GHG emissions have been implemented. A brief description of each of these measures is provided below and the calculation details are located in **Appendix B**, of this document. **Table 2-4** summarizes the reduction in local emissions that is anticipated to result.

Table 2-4: Summary of State Reductions

State Measure	2020 Reduction (MT CO ₂ e)*
Clean Car Standards, AB 1493 (Pavley I)	-5,891
Low-Carbon Fuel Standard (on-road transportation)	-3,847
Low-Carbon Fuel Standard (off-road vehicles)	-548
Title 24	-406
Renewable Portfolio Standard	-6,248
Total State Reduction	-16,940

*Refer to **Appendix B** for calculation details

Clean Car Standards, AB 1493 (Pavley I)

Signed into law in 2002, AB 1493 (Pavley I standard) requires vehicle manufacturers to reduce GHG emissions from new passenger vehicles and light trucks from 2009 through 2016. The CARB anticipates that the Pavley I standard will reduce GHG emissions from new California

2.0 GHG EMISSIONS AND REDUCTION TARGET

passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016. The Pavley I standard is expected to reduce transportation sector emissions in Arroyo Grande by approximately 5,891 MT CO₂e, or 13 percent, in 2020 compared to business-as-usual levels.

Low Carbon Fuel Standard

The Low Carbon Fuel Standard requires a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. Measured on a lifecycle basis, the carbon intensity represents the CO₂e emitted from each stage of producing, transporting, and using the fuel in a motor vehicle. This translates to an approximately nine percent (or 3,847 MT CO₂e) reduction in Arroyo Grande's on-road transportation sector GHG emissions and a 10 percent reduction in its off-road sector GHG emissions in 2020 compared to business-as-usual levels.

Title 24

Although it was not originally intended specifically to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated periodically to allow consideration and possible incorporation of new energy-efficient technologies and methods. The updates that have occurred since the 2005 baseline year and, therefore, were not included in the business-as-usual forecast, include the 2008 and 2013 Title 24 Energy Efficiency Standards. The California Energy Commission estimates that the 2008 standards reduce consumption by 10 percent for new residential buildings and five percent for new commercial buildings, relative to the 2005 standards. For projects implemented after January 1, 2014, the California Energy Commission estimates that the 2013 Title 24 Energy Efficiency Standards will reduce consumption by 25 percent for new residential buildings and 30 percent for new commercial buildings, relative to the 2008 standards. The 2008 and 2013 Title 24 requirements would reduce emissions in Arroyo Grande by approximately 406 MT CO₂e in 2020.²

Renewable Portfolio Standard

The State of California Renewable Portfolio Standard requires investor-owned utilities, electric service providers, and community choice aggregators to increase the portion of energy that comes from renewable sources to 20 percent by 2010 and 33 percent by 2020. PG&E is the electricity provider in Arroyo Grande. In order to calculate future emissions that take into account the Renewable Portfolio Standard, PG&E's 2020 emissions factor was applied (PG&E, 2011). As shown in **Table 2-4**, the Renewable Portfolio Standard would reduce Arroyo Grande's GHG emissions by approximately by 6,248 MT CO₂e, or 40 percent, in 2020.

Sustainable Communities and Climate Protection Act – Senate Bill 375

SB 375, the Sustainable Communities and Climate Protection Action of 2008, enhances California's ability to reach its AB 32 target by aligning regional transportation planning efforts

² The AB 32 Scoping Plan calls for the continuation of ongoing triennial updates to Title 24 that will yield regular increases in the mandatory energy and water savings for new construction. Future updates to Title 24 standards for residential and non-residential alterations are not taken into consideration due to lack of data and certainty about the magnitude of energy savings that will be realized with each subsequent update.

2.0 GHG EMISSIONS AND REDUCTION TARGET

with land use and housing allocations in order to reduce transportation-related GHG emissions. As mentioned in Chapter 1, *Introduction*, SLOCOG must reduce per capita GHG emissions from passenger vehicles by eight percent relative to 2005 levels in 2020 and 2030.

While the outcome of SB 375 in terms of a reduction in VMT per capita is specified by the State, achievement of the target is dependent on regional and local actions and activities that are not regulated by the State. Many of these actions and activities are inextricably linked to local actions which rely on implementation assumptions that will need to be monitored to ensure effectiveness. Therefore, GHG reductions resulting from implementation of SB 375 have not been included as a State measure that would reduce GHG emissions within Arroyo Grande.

B. INCORPORATION OF LOCAL REDUCTIONS INTO FORECAST

In addition to the State measures described above, the City of Arroyo Grande has implemented a number of local measures since the 2005 baseline inventory year that will reduce the community's GHG emissions. It is important to note that local measures which rely on future implementation actions and assumptions are included in Chapter 3, *Climate Action Measures*, as they will need to be monitored to ensure effectiveness. A brief description of each of these local measures is provided below by topic area and the local reduction in GHG emissions in 2020 is summarized in **Table 2-5** (see **Appendix B** for supporting details).

Table 2-5: Summary of Local Reductions

Local Measure	2020 Reduction (MT CO ₂ e)
Energy	
Solar Energy Installations (Residential and Commercial)	-389
Energy Efficient Street Lights	-3
City-owned Building Energy Efficiency Improvements	-13
Transportation and Land Use	
Increase Density and Diversity of Land Uses	Included in Chapter 3 as a CAP measure ¹
Bicycle and Pedestrian Network Improvements	-81
Reduced Parking Requirements	Included in Chapter 3 as a CAP measure ¹
Park and Ride Improvements	-2
Waste	
Construction and Demolition Debris Recycling	-386
Water	
Water Conservation Programs to Meet SB X7-7 Target	-43
Urban Greening	
Tree Planting	-3
Other	
Green Business Corridor Program	Not quantified – support measure ²
Total Reduction from Local Measures	
	-920

¹ The reductions associated with this measure are quantified and included as part of the CAP measures identified in Chapter 3.

² This measure is supportive of overall GHG reductions, but does not directly reduce GHG emissions.

2.0 GHG EMISSIONS AND REDUCTION TARGET

Energy Measures

Between 2006 and 2012, more than 1,482 kilowatts (kW) of solar photovoltaic systems and hot water heaters were installed on or in homes and businesses in Arroyo Grande, which result in a reduction of 389MT CO₂e.

In addition, since 2005, the City has implemented energy efficiency improvements, such as the installation of new efficient lighting fixtures and bulbs, street lights, and vending machines, and upgrades to HVAC systems. These improvements have reduced electricity use by approximately 92,721 kWh and reduced natural gas use by 587 therms for a combined reduction of 16 MT CO₂e in 2020.

Transportation and Land Use Measures

New bicycle routes, street and sidewalk improvements, and park and ride facility improvements installed between 2006 and 2012 are projected to reduce emissions by approximately 83 MT CO₂e in 2020.

Solid Waste Measures

As of 2010, the California Green Building Code requires all local jurisdictions to ensure that 50 percent of all non-hazardous construction and demolition solid waste is diverted from landfills. Within Arroyo Grande, this would reduce emissions by an estimated 386 MT CO₂e in 2020.

Water Measures

The City has implemented a number of programs to reduce per capita water consumption by 20 percent, pursuant to SB X7-7. These programs include plumbing retrofits, turf removal, low-flow fixtures, and smart irrigation systems. In 2020, water conservation programs are expected to reduce GHG emissions by approximately 43 MT CO₂e.

Urban Greening Measures

Between 2006 and 2012, the City of Arroyo Grande planted 250 trees, which are estimated to sequester three MT CO₂e in 2020.

Other

In 2009, Arroyo Grande developed a Green Business Corridor Program that provides economic incentives to attract new “green” businesses along El Camino Real. The program targets incentives into one area to attract businesses that will support one another and to attract customers to a one-stop area for green products and services. To date, the City has not received any commitment to the program.

C. ADJUSTED FORECAST

As shown in **Table 2-6**, State and local measures will reduce GHG emissions in Arroyo Grande by an estimated 17,860 MT CO₂e in 2020. Under the adjusted scenario GHG emissions are projected to decrease to 75,653 MT CO₂e (approximately 19 percent below the business-as-usual scenario of 93,513 MT CO₂e).

2.0 GHG EMISSIONS AND REDUCTION TARGET

Table 2-6: Summary of Reductions from State and Local Measures and 2020 GHG Emissions

	GHG Emissions (MT CO₂e)
2020 Business-as-Usual Forecast	93,513
2020 Reduction from State Measures	-16,940
2020 Reduction from Local Measures	-920
Total Reduction from State and Local Measures	-17,860
2020 Adjusted Forecast	75,653

2.3 GHG Emissions Reduction Target

The City is committed to reducing its share of GHG emissions consistent with AB 32. The AB 32 Scoping Plan calls on local governments to establish a reduction target that “parallels the State’s commitment to reduce GHG emissions by approximately 15 percent from current levels by 2020.” Therefore, this CAP establishes a reduction target of 15 percent below 2005 levels by 2020. The 2005 baseline GHG emissions inventory and 2020 GHG emissions forecast under the adjusted scenario provide the necessary background for the City to identify the reduction in emissions needed from local measures to meet this target.

As shown in **Table 2-7** and **Figure 2-4**, based on the 15 percent reduction target, Arroyo Grande would need to reduce its community-wide emissions to 71,739 MT CO₂e by 2020. To meet this target, Arroyo Grande will need to reduce its GHG emissions five percent below the adjusted forecast levels³ (equivalent to 3,914 MT CO₂e) by 2020 through implementation of local measures and actions.

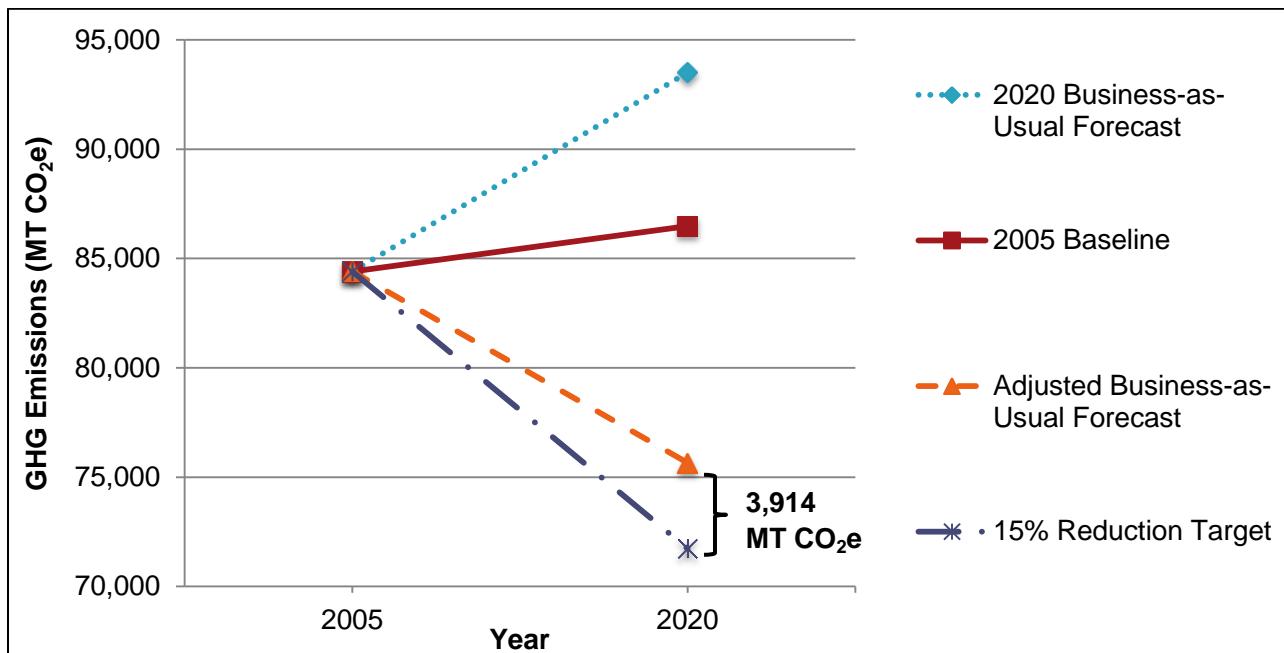
Table 2-7: Arroyo Grande’s GHG Emissions, Target, and Reduction Necessary to Meet Target

	GHG Emissions (MT CO₂e)
2005 Baseline Emissions	84,399
2020 Adjusted Forecast	75,653
Target (15% below 2005 levels by 2020)	71,739
Remaining Gap Necessary to Meet Target	3,914

³ As described in Section 2.3, the adjusted 2020 forecast accounts for approved, programmed, and/or adopted State- and local-level measures that will reduce local GHG emissions. Therefore, it is used to determine the necessary reductions to meet the City’s reduction target as it provides a more accurate picture of future emissions growth and the proportionate share of emissions the City must reduce once State measures to reduce GHG emissions have been implemented.

2.0 GHG EMISSIONS AND REDUCTION TARGET

Figure 2-4: GHG Emissions in Relation to the Target



CHAPTER 3

CLIMATE ACTION MEASURES

3.0 Climate Action Measures

This chapter identifies the measures that the City will implement to achieve its GHG emissions reduction target of 15 percent below 2005 levels by 2020. The City has identified a set of measures based on careful consideration of the reductions in GHGs needed to achieve the target, the sources and distribution of emissions identified in the GHG emissions inventory, existing priorities and resources, and the potential costs and benefits of each measure. Many of the CAP measures are also consistent with the measures of neighboring jurisdictions and regional agencies which is important for feasible and effective implementation of GHG reduction measures. Detailed analyses of the GHG reduction potential and estimated costs and savings for each measure are located in **Appendix B**.

3.1 Chapter Organization

The climate action measures, which represent ways to reduce GHG emissions, are organized into the following focus areas: City government, energy, transportation and land use, off-road, solid waste, and tree planting. The discussion of each focus area begins with an introduction, followed by a summary table listing the measures within the focus area and the associated GHG reduction potential, where applicable. Following the introduction to each focus area, each measure is presented with the following information:

- **Existing or Completed Efforts:** a list of efforts the City has implemented or is in the process of implementing since the baseline year (2005) to accomplish the measure.
- **Implementation Actions:** the specific steps the City will take to achieve the GHG emission reduction and outcome of the measure.
- **GHG Reduction Potential:** the estimated reduction in GHG emissions anticipated in 2020.
- **Costs and Savings:** potential costs and savings to the City or community (private) are categorized as none, very low, low, medium, and high. **Table 3-1** summarizes these category definitions. Costs account for the expense that would occur beyond conducting business-as-usual (i.e., without implementation of the CAP).

Table 3-1: Measure Cost and Savings

Aggregated City Government Costs/Savings	Per Unit Community Cost/Savings
Very Low: \$1 - \$10,000	Very Low: \$1 - \$500
Low: \$10,001 - \$50,000	Low: \$501 - \$1,000
Medium: \$50,001 - \$100,000	Medium: \$1,001 - \$5,000
High: \$100,001 or greater	High: \$5,001 or greater

Details related to measure implementation and monitoring, including responsible parties, performance criteria, implementation time frames, and potential funding sources are located in Chapter 5, *Implementation and Monitoring*.

3.2 City Government Operations Measures

The City has already taken a number of steps that have resulted in GHG emissions reductions, as identified in Chapter 2, *GHG Emissions and Reduction Target*, and is committed to building on those efforts. This focus area identifies measures and actions the City can implement to further reduce GHG emissions from City government operations and facilities. Although the GHG emissions that result from City government operations and facilities account for only two percent of Arroyo Grande's community emissions, as an employer, property-owner, and regulatory entity, the City can set an example of GHG emissions reduction practices for the community and demonstrate additional benefits of the measures beyond reducing GHG emissions, such as cost savings in buildings and operations and improved operational efficiency. As shown in **Table 3-2**, the City government operations measures have the potential to reduce Arroyo Grande's GHG emissions by 80 MT CO₂e by 2020.

In addition to reducing GHG emissions, the City government measures described in this section have the potential to provide other important benefits to the community. These benefits include:

- City leadership
- Reduced operating and maintenance costs
- Improved public health
- Improved air and water quality
- Resource conservation
- City beautification
- Lower maintenance costs and extended equipment lives

Table 3-2: City Government Operations GHG Reductions by Measure

Measure Number	Measure	2020 GHG Reductions (MT CO ₂ e)
C-1	City Government Energy Efficiency Retrofits and Upgrades	48
C-2	City Government Energy Efficient Public Realm Lighting	7
C-3	Energy Efficiency Requirements for New City-owned Buildings	8
C-4	Zero- and Low-Emission City Fleet Vehicles	13
C-5	City Government Solid Waste Reduction	1
C-6	City Government Tree Planting Program	3
City Government Operations Total		80

C-1: City Government Energy Efficiency Retrofits and Upgrades

Establish a goal to reduce City government energy use by 20 percent by 2020 and implement cost-effective improvements and upgrades to achieve that goal.

Implementation Actions:

- **C-1.1:** Formalize the City government energy use reduction goal of 20 percent.
- **C-1.2:** Complete energy audits and benchmarking of all City-owned or -operated facilities, leveraging existing programs, such as PG&E's Automated Benchmarking Service or the U.S. EPA's ENERGY STAR Challenge program.
- **C-1.3:** Maintain a regular maintenance schedule for heating and cooling, ventilation and other building functions.
- **C-1.4:** Establish a prioritized list of energy efficiency upgrade projects and implement them as funding becomes available.

GHG Reduction Potential:

48 MT CO₂e

City Cost:

Varies

City Savings:

Medium

Private Cost:

None

Private Savings:

None

C-2: City Government Energy Efficient Public Realm Lighting

Continue to replace City-owned or -operated street, traffic signal, park, and parking lot lights with higher efficiency lamp technologies.

Existing and/or Completed Efforts in Support of Measure:

- Since 2005, the City has replaced 38 inefficient City-owned or -operated public lighting.

Implementation Actions:

- **C-2.1:** Conduct an inventory of existing outdoor public light fixtures.
- **C-2.2:** Continue to identify and secure funding to replace inefficient City-owned or -operated public lighting.

GHG Reduction Potential:

7 MT CO₂e

City Cost:

Low

City Savings:

Low

Private Cost:

None

Private Savings:

None

3.0 CLIMATE ACTION MEASURES

C-3: Energy Efficiency Requirements for New City-owned Buildings

Adopt a policy to exceed 2013 Title 24 Building Energy Efficiency Standards by 20 percent for the construction or renovation of new City buildings and facilities.

Implementation Actions:

- **C-3.1:** Adopt a policy to exceed Title 24 building efficiency standards by 20 percent.

GHG Reduction Potential:

8 MT CO₂e

City Cost:

Low

City Savings:

Very Low

Private Cost:

None

Private Savings:

None

C-4: Zero- and Low-Emission City Fleet Vehicles

Replace official City vehicles with zero-emission and low-emission vehicles, including smaller, hybrid, electric, compressed natural gas, biodiesel, and neighborhood electric vehicles.

Implementation Actions:

- **C-4.1:** Replace 10 City vehicles with zero-emission or low-emission vehicles by 2020.

GHG Reduction Potential:

13 MT CO₂e

City Cost:

Medium

City Savings:

Very Low

Private Cost:

None

Private Savings:

None

C-5: City Government Solid Waste Reduction

Adopt a 15 percent solid waste diversion rate over 2005 baseline levels and identify steps to meet that rate by 2020.

Existing and/or Completed Efforts in Support of Measure:

- Since 2005, the City has installed recycling receptacles at City-owned or -operated buildings and facilities.

Implementation Actions:

- **C-5.1:** Develop and adopt a City purchasing policy that emphasizes recycled and recyclable materials.

GHG Reduction Potential:

1 MT CO₂e

City Cost:

Low

City Savings:

None

Private Cost:

None

Savings:

None

C-6: City Government Tree Planting Program

Establish a tree planting program to increase the number of native, drought-tolerant trees on City-owned property, parks and streetscapes.

Implementation Actions:

- **C-6.1:** Develop and adopt a formal tree planting policy or program and plant at least 250 trees by 2020.
- **C-6.2:** Identify and secure grant funding to plant trees on City properties.

GHG Reduction Potential:

3 MT CO₂e

City Cost:

Low

City Savings:

None

Private Cost:

None

Savings:

None

3.3 Community-wide Measures

3.3.1 ENERGY MEASURES

Energy use accounted for 44 percent of Arroyo Grande's total GHG emissions in 2005. These emissions result from the combustion of fossil fuel, primarily coal, oil, and natural gas, which is used to heat, cool, and provide power to residential, commercial, and industrial buildings and other facilities. Factors affecting energy-related emissions in buildings include building design and the efficiency of technology and electronics in buildings. GHG emissions reductions can be achieved both by changes to the energy demand (e.g., improving energy efficiency and reducing consumption) and energy supply (e.g., switching from a high-carbon to a low- or zero-carbon technology or fuel). The energy measures listed in **Table 3-3** focus on these strategies and have the potential to reduce Arroyo Grande's GHG emissions by 1,742 MT CO₂e by 2020.

In addition to reducing GHG emissions, the energy measures described in this section have the potential to provide other important benefits to the community, including:

- Reduced energy and operating costs
- Lower maintenance costs and extended equipment lives
- Increased building re-sale value
- Strengthened local economy
- Resource conservation
- Increased electricity reliability
- Improved air quality

Table 3-3: Energy GHG Reductions by Measure

Measure Number	Measure	2020 GHG Reductions (MT CO ₂ e)
E-1	Energy Efficiency Outreach and Incentive Programs	141
E-2	Energy Audit and Retrofit Program	151
E-3	Income-Qualified Energy Efficient Weatherization Programs	126
E-4	Energy Conservation Ordinance	621
E-5	Incentives for Exceeding Title 24 Building Energy Efficiency Standards	117
E-6	Energy Efficient Public Realm Lighting Requirements	8
E-7	Small-Scale On-Site Solar Photovoltaic (PV) Incentive Program	439
E-8	Income-Qualified Solar PV Program	139
Energy Total		1,742

3.0 CLIMATE ACTION MEASURES

Measure E-1: Energy Efficiency Outreach and Incentive Programs

Expand participation in and the promotion of existing programs, such as Energy Upgrade California and San Luis Obispo County Energy Watch, and develop new incentives to increase community awareness of existing energy efficiency rebates and financial incentives.

Implementation Actions:

- **E-1.1:** Conduct additional outreach and promotional activities, either individually or in collaboration with San Luis Obispo County Energy Watch, targeting specific groups or sectors within the community (e.g., homeowners, renters, businesses, etc.).
- **E-1.2:** Designate one week per year to conduct an energy efficiency outreach campaign targeting a specific group. The campaign week can also be used to recognize and encourage programs and educational outreach conducted by industry organizations, non-governmental entities, government agencies, and other community groups.
- **E-1.3:** Direct community members to existing program websites, such as Energy Upgrade California and San Luis Obispo County Energy Watch.
- **E-1.4:** Work with the County of San Luis Obispo and other partners to offer increased incentives to residential and commercial property owners to install energy efficiency retrofit improvements.

GHG Reduction Potential:

141 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

Very Low

Measure E-2: Energy Audit and Retrofit Program

Facilitate voluntary energy assessments, retrofits, and retrocommissioning of residential and commercial buildings within Arroyo Grande.

Implementation Actions:

- **E-2.1:** Collaborate with San Luis Obispo County Energy Watch, local utilities, and local jurisdictions to develop and promote a residential and commercial energy audit program.
- **E-2.2:** Conduct outreach and promotional activities targeting specific groups (e.g., owners of buildings built prior to Title 24 [1980]) in order to promote the audit and retrofit program.
- **E-2.3:** As part of the business licensing and renewal process, encourage businesses to participate in the program and receive an energy audit.

GHG Reduction Potential:

151 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

Medium

Private Savings:

Very Low

3.0 CLIMATE ACTION MEASURES

- **E-2.4:** Participate in and promote an energy efficiency financing program to encourage investment in residential and commercial energy efficiency building upgrades.
- **E-2.5:** Work with Energy Upgrade California, local utilities, and/or community businesses and organizations, to annually conduct a "do-it-yourself" workshop for building energy retrofits.
- **E-2.6:** Highlight the effectiveness of energy audits and retrofits by showcasing the success of retrofit projects (e.g., on the City's website or in its newsletter).

Measure E-3: Income-Qualified Energy Efficient Weatherization Programs

Facilitate energy efficient weatherization of low- and middle-income housing through promotion of existing programs.

Implementation Actions:

- **E-3.1:** Facilitate and promote existing income-qualified weatherization programs, such as PG&E's Middle Income Direct Install program, either individually or by partnering with a local organization.

GHG Reduction Potential:
126 MT CO₂e
City Cost:
Very Low
City Savings:
None
Private Cost:
None
Private Savings:
Low

Measure E-4: Energy Conservation Ordinance

Require through a new City ordinance that cost-effective energy efficiency upgrades in existing buildings be implemented at point of sale or during major renovation of residential units. A maximum cost ceiling would be established to protect owners from excessive fees.

Implementation Actions:

- **E-4.1:** Develop and adopt a local residential energy conservation ordinance, including establishment of a maximum cost ceiling.

GHG Reduction Potential:
621 MT CO₂e
City Cost:
Low
City Savings:
None
Private Cost:
Medium
Private Savings:
Very Low to Medium

Measure E-5: Incentives for Exceeding Title 24 Energy Efficiency Building Standards

Provide incentives (e.g., priority permitting, reduced permit fees, etc.) for new development and/or major remodels that voluntarily exceed State energy efficiency standards by 20 percent.

Implementation Actions:

- **E-5.1:** Collaborate with community organizations and businesses, local utilities, and other local jurisdictions in the region to develop and promote a technical assistance and best practices program that aids developers in selecting and implementing energy efficiency measures that exceed State standards.
- **E-5.2:** Identify, provide and promote incentives (e.g., expedited or streamlined permitting, deferred fees, public recognition, etc.) for applicants whose project exceeds State requirements by 20 percent.
- **E-5.3:** Update building permit process to incentivize higher building performance (e.g. buildings that integrate and optimize major high-performance building attributes, including energy efficiency, durability, and life-cycle performance).
- **E-5.4:** Launch an educational campaign for builders, permit applicants, and the general public to promote best practices and incentive programs; provide information and assistance about energy efficiency options online and at permit counter.

Measure E-6: Energy Efficient Public Realm Lighting Requirements

Require through a new City ordinance that new development utilize high efficiency lights in parking lots, streets, and other public areas.

Implementation Actions:

- **E-6.1:** Develop and adopt an ordinance that requires new development to utilize high efficiency lights in parking lots, streets, and other public areas.

GHG Reduction Potential:

117 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

Medium to High

Private Savings:

Very Low to Medium

GHG Reduction Potential:

8 MT CO₂e

City Cost:

Very Low

City Savings:

Very Low

Private Cost:

Very Low

Private Savings:

Very Low

3.0 CLIMATE ACTION MEASURES

Measure E-7: Small-Scale On-Site Solar PV Incentive Program

Facilitate the voluntary installation of small-scale on-site solar PV systems and solar hot water heaters in the community through expanded promotion of existing financial incentives, rebates, and financing programs, and by helping the average resident and business overcome common regulatory barriers and upfront capital costs.

Implementation Actions:

- **E-7.1:** Collaborate with other local jurisdictions in the region to standardize requirements across jurisdiction, by using common promotion and permit materials, such as checklists and standard plans, to reduce permit submittal errors among contractors working throughout a region.
- **E-7.2:** Participate in and promote a renewable energy financing program for residential and non-residential property owners.
- **E-7.3:** Expand education on and promotion of existing incentive, rebate, and financing programs for small-scale on-site solar PV systems and solar hot water heaters targeting specific groups or sectors within the community.

GHG Reduction Potential:

439 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

High

Private Savings:

Medium to High

Measure E-8: Income-Qualified Solar PV Program

Facilitate the installation of small-scale on-site solar PV systems on and solar hot water heaters in income-qualified housing units by promoting existing programs offered through the California Solar Initiative and New Solar Homes Partnership and by collaborating with organizations, such as Grid Alternatives, on outreach and eligibility.

Existing and/or Completed Efforts in Support of Measure:

- The City has collaborated with Grid Alternatives to provide targeted education and outreach to developers and homeowners about incentives offered through the Single Family Affordable Solar Homes (SASH) Program.

GHG Reduction Potential:

139 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

Medium

Implementation Actions:

- **E-8.1:** Collaborate with Grid Alternatives and other community organizations to provide targeted education and outreach to developers and homeowners about incentives offered through the Multifamily Affordable Solar Homes (MASH) Program.
- **E-8.2:** Provide targeted outreach regarding solar water heating incentives offered through the California Solar Initiative.

3.3.2 TRANSPORTATION AND LAND USE MEASURES

Transportation-related emissions accounted for 44 percent of Arroyo Grande's 2005 GHG emissions inventory. Factors affecting GHG emissions from transportation include the number of VMT, fuel economy, and the type of fuel used. The number of VMT is directly influenced by the geographic distribution of people and places, especially the density of development and zoning. Therefore, land use measures are included as reduction policies in this section. The transportation and land use measures listed in **Table 3-4** focus on these strategies and have the potential to reduce Arroyo Grande's GHG emissions by 3,100 MT CO₂e by 2020.

The transportation and land use measures in this section will not only help reduce GHG emissions, but also provide multiple other benefits to the community. These include:

- Reduced transportation costs
- Reduced traffic congestion
- Improved public health
- Strengthened local economy
- Improved infrastructure
- Increased equity
- Increased housing and travel options
- Resource conservation
- Reduced noise, air, and water pollution

Table 3-4: Transportation and Land Use GHG Reductions by Measure

Measure Number	Measure	2020 GHG Reductions (MT CO ₂ e)
TL-1	Bicycle Network	140
TL-2	Pedestrian Network	119
TL-3	Transit Travel	Supportive ¹
TL-4	Transportation Demand Management (TDM) Incentives	35
TL-5	Parking Supply Management	19
TL-6	Electric Vehicle Network and Alternative Fueling Stations	1,056
TL-7	Smart Growth	1,731
Transportation and Land Use Total		3,100

¹ GHG reductions from this measure are supportive of and grouped under Measure TL-7.

3.0 CLIMATE ACTION MEASURES

Measure TL-1: Bicycle Network

Continue to improve and expand the City's bicycle network and infrastructure.

Existing and/or Completed Efforts in Support of Measure:

- The City annually identifies and schedules street improvement and maintenance projects to preserve and enhance the bicycle network.
- The City incorporates bicycle facility improvements into pavement resurfacing, restriping, and signalization operations where the safety and convenience of users can be improved within the scope of work.
- The City coordinates with and supports SLOCOG in the implementation of bicycle plans to facilitate non-auto travel within and between communities.
- Through conditions of approval, the City requires new subdivisions and large developments to incorporate bicycle lanes, routes, and/or shared-use paths into street systems to provide a continuous network of routes, facilitated with markings, signage, and bicycle parking.
- The City enforces mandatory California Green Building Standards Code bicycle parking standards for non-residential development.

Implementation Actions:

- **TL-1.1:** Continue to pursue public and private funding to expand and link the City's bicycle network in accordance with the General Plan and Bicycle Plan.
- **TL-1.2:** Collaborate with the San Luis Obispo Bicycle Coalition to assist with event promotions and publications to increase awareness and ridership during Bike Month.

Measure TL-2: Pedestrian Network

Continue to improve and expand the City's pedestrian network.

Existing and/or Completed Efforts in Support of Measure:

- The City pursues public and private funding to expand the City's pedestrian network and Safe Routes to School program.
- The City annually identifies and schedules sidewalk improvement and maintenance projects to preserve and enhance the pedestrian circulation network.

GHG Reduction Potential:

140 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

Very Low

GHG Reduction Potential:

119 MT CO₂e

City Cost:

None

City Savings:

None

Private Cost:

None

Private Savings:

Varies

3.0 CLIMATE ACTION MEASURES

- The City incorporates pedestrian facilities improvements into pavement resurfacing, restriping, and signalization operations where the safety and convenience of users can be improved within the scope of work.
- The City requires through conditions of approval that new development projects provide a pedestrian access network that internally links all uses and connects all existing or planned external streets and pedestrian facilities contiguous with the project site. The City also requires through conditions of approval that the new development projects minimize barriers to pedestrian access and interconnectivity.
- The City require new development to implement traffic calming improvements as appropriate (e.g., marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, median islands, mini-circles, tight corner radii, etc.) through conditions of approval.

Implementation Actions:

- **TL-2.1:** Continue to pursue public and private funding to expand and link the City's pedestrian network.
- **TL-2.2:** Continue to expand and promote the Safe Routes to School program.

Measure TL-3: Transit Travel

Work with the Regional Transit Authority (RTA) and South County Transit to increase transit ridership.

Existing and/or Completed Efforts in Support of Measure:

- The City coordinates with RTA and transit service providers to implement the Short Range Transit Plan.
- The City works with RTA and local transit agency to identify and map existing and future bus lines (routes) and transit corridors.
- The City supports the addition of transit routes that provide intercity express services.

Implementation Actions:

- **TL-3.1:** Coordinate with RTA and South County Transit to facilitate the use of transit by increasing its safety, cleanliness, and accessibility.
- **TL-3.2:** Through the development review process, require new development to provide safe and convenient access to public transit within and/or contiguous to the project area as feasible.

GHG Reduction Potential:
Supportive ²
City Cost:
Very Low
City Savings:
None
Private Cost:
None
Private Savings:
None

² GHG reductions from this measure are supportive of and grouped under Measure TL-7.

3.0 CLIMATE ACTION MEASURES

Measure TL-4: Transportation Demand Management (TDM) Incentives

Work with San Luis Obispo Regional Ride Share and Ride-On to conduct additional outreach and marketing of existing TDM programs and incentives to discourage single-occupancy vehicle trips and encourage alternative modes of transportation, such as carpooling, taking transit, walking, and biking.

Existing and/or Completed Efforts in Support of Measure:

- The City currently collaborates with San Luis Obispo Ride Share and Ride-On.

Implementation Actions:

- **TL-4.1:** Conduct additional outreach through event promotions and publications, targeting specific groups or sectors within the community (e.g., employers, employees, students, seniors, etc.).
- **TL-4.2:** Provide information on and promote existing employer based TDM programs as part of the business licensing and renewal process.
- **TL-4.3:** Continue to collaborate with San Luis Obispo Ride Share and the San Luis Obispo Bicycle Coalition to assist with event promotions and publications to increase awareness and ridership during Bike Month and Rideshare month.
- **TL-4.4:** Direct community members to existing program websites (e.g., Ride Share, Ride-On) by providing links on the City's website.

Measure TL-5: Parking Supply Management

Reduce parking requirements in areas such as the downtown where a variety of uses and services are planned in close proximity to each other and to transit.

Existing and/or Completed Efforts in Support of Measure:

- The City has amended the Municipal Code to reduce parking requirements (e.g., eliminate or reduce minimum parking requirements, create maximum parking requirements, and/or allow shared parking).
- The City has established in-lieu fees in place of minimum parking requirements in the Village.

Implementation Actions:

- **TL-5.1:** Continue to implement reduced parking requirements where appropriate.

GHG Reduction Potential:

35 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

Very Low

GHG Reduction Potential:

19 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

Very Low

Measure TL-6: Electric Vehicle Network and Alternative Fueling Stations

Continue to work with the APCD, Central Coast Clean Cities Coalition, and neighboring jurisdictions to create and implement the electric vehicle readiness plan.

Existing and/or Completed Efforts in Support of Measure:

- The City is currently working with the APCD, Central Coast Clean Cities Coalition, and neighboring jurisdictions to create the electric vehicle readiness plan.

Implementation Actions:

- **TL-6.1:** Continue to develop and implement the electric vehicle readiness plan through expanding the use of alternative fuel vehicles and fueling stations in the community (e.g., through identifying and zoning locations for fueling stations, offering incentives for alternative fuel vehicles, etc.).
- **TL-6.2:** Provide streamlined installation and permitting procedures for vehicle charging facilities, utilizing tools provided in the electric vehicle readiness plan (e.g., sample charging permits, model ordinances, development guidelines, outreach programs).
- **TL-6.3:** Continue to pursue funding for plug-in electric vehicle charging stations.

Measure TL-7: Smart Growth

Identify and implement additional incentives to encourage mixed-use, higher density, and infill development near existing or planned transit stops, in existing community centers/downtown, and in other designated areas.

Existing and/or Completed Efforts in Support of Measure:

- The City has updated its land use and zoning code to allow new development in the mixed-use and very high-density land use categories located within ¼-mile of a transit node, existing bus route, or park and ride facility.

Implementation Actions:

- **TL-7.1:** Provide and promote incentives (e.g., parking reductions, priority permitting, etc.) for mixed-use and very high-density development that has a minimum density of 20 dwelling units per acre and is located within ¼-mile of an existing or planned transit stop or park and ride facility with regularly scheduled, daily service.

GHG Reduction Potential:

1,056 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

None

GHG Reduction Potential:

1,731 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

Varies

Private Savings:

High

3.0 CLIMATE ACTION MEASURES

- **TL-7.2:** Develop a form-based zoning code for the central business district/downtown. Form-based codes emphasize building form rather than use. This increases flexibility for a variety of complementary uses to be permitted in the same area, and the potential for mixed-use development, which helps to reduce vehicle miles traveled.

3.3.3 OFF-ROAD MEASURE

Emissions in the off-road sector result from the combustion of fuel, primarily diesel, gasoline, and compressed natural gas, which is used to power off-road equipment and vehicles. Off-road equipment and vehicles include those used in construction, agriculture, commercial, industrial, and landscaping operations as well as recreational vehicles. Factors affecting off-road emissions include the age, type, and usage of the vehicle or equipment.

GHG emissions reductions can be achieved by reducing off-road equipment and vehicle usage and idling or by using equipment that runs on electricity or alternative fuels. The off-road equipment measure listed in **Table 3-5** has the potential to reduce Arroyo Grande's GHG emissions by 440 MT CO₂e by 2020.

The off-road measure in this section will not only help reduce GHG emissions, but will also provide multiple other benefits to the community. These include:

- Improved air and water quality
- Reduced noise pollution
- Improved public health

Table 3-5: Off-Road GHG Reductions by Measure

Measure Number	Measure	2020 GHG Reductions (MT CO ₂ e)
O-1	Off-Road Vehicle and Equipment Upgrades, Retrofits, and Replacements	440
Off-Road Total		440

3.0 CLIMATE ACTION MEASURES

Measure O-1: Off-Road Vehicle and Equipment Upgrades, Retrofits, and Replacements

Continue to work with the APCD and promote existing programs that fund off-road vehicle and equipment upgrades, retrofits, and replacement through the Carl Moyer heavy-duty vehicle and equipment program or other funding mechanisms.

Implementation Actions:

- **O-1.1:** Conduct additional outreach and promotional activities targeting specific groups (e.g., agricultural operations, construction companies, homeowners, etc.).
- **O-1.2:** Direct community members to existing program websites (e.g., APCD, Carl Moyer Grant page).

GHG Reduction Potential:

440 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

Varies

3.3.4 SOLID WASTE MEASURE

As solid waste decomposes in landfills, it releases methane, a GHG 21 times more potent than carbon dioxide (US EPA, 2012). In 2005, Arroyo Grande sent approximately 20,245 tons of waste to landfills, including recycled materials used for cover.

Waste management is an important action that the community can take to reduce GHG emissions. Waste management can be achieved by reducing the amount of trash and other waste that is discarded; reusing containers, products, and building materials; and recycling as many materials as possible, including green waste and construction materials. The solid waste measure listed in **Table 3-7** has the potential to reduce Arroyo Grande's GHG emissions by 3 MT CO₂e by 2020.

In addition to reducing GHG emissions, the solid waste measure described in this section has the potential to provide other important benefits to the community. These include:

- Improved air quality
- Resource conservation

Table 3-6: Solid Waste GHG Reductions by Measure

Measure Number	Measure	2020 GHG Reductions (MT CO ₂ e)
S-1	Recycling at Public Events	3
Solid Waste Total		3

3.0 CLIMATE ACTION MEASURES

Measure S-1: Recycling at Public Events

The City would adopt an ordinance requiring the provision of recycling receptacles at all events requiring a permit or held on City-owned or -operated property.

Implementation Actions:

- **S-1.1:** Develop and adopt an event recycling ordinance.

GHG Reduction Potential:

3 MT CO₂e

City Cost:

Very Low

City Savings:

None

Private Cost:

None

Private Savings:

None

3.3.5 TREE PLANTING MEASURE

Trees and other vegetation absorb and capture the GHG carbon dioxide from the atmosphere in a process called carbon sequestration. By maintaining a healthy urban forest, prolonging the life of trees, and continually increasing the number of trees, Arroyo Grande can increase its net carbon storage over the long term. Trees and other vegetation also reduce local air and surface temperatures by shading buildings, streets, and sidewalks.

The tree planting measure listed in **Table 3-8** has the potential to reduce Arroyo Grande's GHG emissions by 6 MT CO₂e by 2020.

In addition to reducing GHG emissions, the tree planting measure described in this section has the potential to provide other important benefits to the community. These include:

- City beautification
- Increased property values
- Improved air quality
- Improved water quality
- Improved public health
- Reduced surface and air temperatures
- Reduced noise pollution

Table 3-7: Tree Planting GHG Reductions by Measure

Measure Number	Measure	2020 GHG Reductions (MT CO ₂ e)
T-1	Tree Planting Program	6
Tree Planting Total		6

3.0 CLIMATE ACTION MEASURES

Measure T-1: Tree Planting Program

Develop a program to facilitate voluntary tree planting within the community, working with local non-profit organizations and community partners. Develop and adopt tree planting guidelines that address tree and site selection.

Existing and/or Completed Efforts in Support of Measure:

- The City currently tracks the number of trees planted annually.

Implementation Actions:

- **T-1.1:** Develop a tree planting assistance program.
- **T-1.2:** Develop and adopt tree planting guidelines that address tree and site selection. Emphasis should be placed on native, drought-tolerant trees.

GHG Reduction Potential:

6 MT CO₂e

City Cost:

Low

City Savings:

None

Private Cost:

Very Low

Private Savings:

None

3.4 GHG Reduction Summary

As discussed in Chapter 2, *GHG Emissions and Reduction Target*, Arroyo Grande will need to reduce its GHG emissions by 3,914 MT CO₂e from the adjusted forecast by 2020 to meet its 15 percent reduction target. The GHG reduction measures in this CAP are estimated to reduce Arroyo Grande's GHG emissions by 5,371 MT CO₂e by 2020, as summarized in **Table 3-8**. Therefore, the implementation of the measures identified in this chapter would enable Arroyo Grande to meet its 15 percent reduction target by 2020.

3.0 CLIMATE ACTION MEASURES

Table 3-8: Summary of GHG Reductions by Measure

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)
City Government Operations		
C-1	City Government Energy Efficiency Retrofits and Upgrades	48
C-2	City Government Energy Efficient Public Realm Lighting	7
C-3	Energy Efficiency Requirements for New City-owned Buildings	8
C-4	Zero- and Low-Emission City Fleet Vehicles	13
C-5	City Government Solid Waste Reduction	1
C-6	City Government Tree Planting Program	3
<i>City Government Operations Subtotal</i>		80
Energy		
E-1	Energy Efficiency Outreach and Incentive Programs	141
E-2	Energy Audit and Retrofit Program	151
E-3	Income-Qualified Energy Efficient Weatherization Programs	126
E-4	Energy Conservation Ordinance	621
E-5	Incentives for Exceeding Title 24 Building Energy Efficiency Standards	117
E-6	Energy Efficient Public Realm Lighting Requirements	8
E-7	Small-Scale Solar PV Incentive Program	439
E-8	Income-Qualified Solar PV Program	139
<i>Energy Subtotal</i>		1,742
Transportation and Land Use		
TL-1	Bicycle Network	140
TL-2	Pedestrian Network	119
TL-3	Expand Transit Network	Supportive
TL-4	TDM Incentives	35
TL-5	Parking Supply Management	19
TL-6	Electric Vehicle Network and Alternative Fueling Stations	1,056
TL-7	Smart Growth	1,731
<i>Transportation and Land Use Subtotal</i>		3,100
Off-Road		
O-1	Off-Road Vehicle and Equipment Upgrades, Retrofits, and Replacements	440
<i>Off-Road Subtotal</i>		440
Solid Waste		
S-1	Recycling at Public Events	3
<i>Solid Waste Subtotal</i>		3
Tree Planting		
T-1	Tree Planting Program	6
<i>Tree Subtotal</i>		6
TOTAL REDUCTION		5,371

CHAPTER 4

ADAPTATION

4.0 Adaptation

There are two responses to climate change available to local governments: mitigation and adaptation. The previous chapter addressed climate change mitigation, by identifying measures to reduce GHG emissions. This chapter identifies measures to prepare for and minimize the risks associated with anticipated climate change impacts and increase resiliency to those changes. Drawing on a recent climate adaptation planning process that took place in San Luis Obispo County, this chapter identifies climate change predictions for the region and specific to Arroyo Grande. This chapter also provides an assessment of populations and infrastructure within Arroyo Grande that are particularly vulnerable to the identified impacts and identifies measures to increase community resilience to those effects.

“Adaptation planning at the local, state, and national levels can limit the damage caused by climate change, as well as reduce the long-term costs of responding to the climate related impacts that are expected to grow in number and intensity in the decades to come” (PEW Center on Global Climate Change, 2011).

4.1 Climate Change Predictions and Vulnerability

Climate change is a global phenomenon that has the potential to impact local health, agriculture, natural resources, infrastructure, emergency response, tourism, and many other facets of society. As climate change continues to progress, increased stress to vulnerable populations and sectors of society are expected. In 2010, key stakeholders, elected officials, city and county planners, land managers, public health officials, concerned citizens, scientists, and the Local Government Commission initiated a process to address climate change adaptation in San Luis Obispo County. As part of this process, scientists from Geos Institute identified anticipated climate change impacts in the region and threats to socioeconomic and natural systems. The range of potential impacts presented in the document *ClimateWise: Integrated Climate Change Adaptation Planning in San Luis Obispo County in November 2010* (ClimateWise) are based on projections of climate change in the San Luis Obispo region using three of the best-available models (MIROC, HadCM, and CSIRO) and an emissions scenario drawn from those used by the Intergovernmental Panel on Climate Change (IPCC).

According to ClimateWise, climate change could lead to the following potential changes in the San Luis Obispo County region and the City of Arroyo Grande:

- Increased temperatures
- Changed precipitation
- Increased frequency and severity of storm events
- Increased burn area from wildfires

Based on these climate changes, a vulnerability assessment was completed to determine the degree to which physical, socioeconomic, and natural factors are susceptible to, or unable to

4.0 ADAPTATION

accommodate, the anticipated effects of climate change. The assessment was comprised of three primary components:

- Exposure – the nature and degree to which a system experiences a stress or hazard.
- Sensitivity – the degree to which the system is impacted by a given stressor, change or disturbance.
- Adaptive Capacity – the ability to cope with extreme events, to make adaptive changes, or to transform to a greater extent, including the ability to moderate potential damages and to take advantage of opportunities.

Each of these components contributes to understanding the overall vulnerability of a functional system (Snover, 2007). Climate change will most impact those individuals and systems that have both the greatest exposure and sensitivity to climate change impacts, in addition to the lowest adaptive capacity (see **Table 4-1**). For each climatic hazard, the population and economic sector most vulnerable depends on the unique combination of these three factors (ClimateWise, 2010).

Table 4-1: Climate Change Vulnerability

Components of Vulnerability	Climatic Risks	Populations or Infrastructure Particularly at Risk
Exposure	Floods Heat Drought Wildfire	Floodplain residents Outdoor workers Farmers, all water users Homes at the wildland-urban interface
Sensitivity	Heat Air pollution Drought	Infants, elderly Asthma sufferers, children Farmers
Adaptive Capacity	Floods Heat	Institutionalized populations, low-income households Low-income residents

Source: ClimateWise, 2010

4.1.1 INCREASED TEMPERATURES

Average temperatures in San Luis Obispo County are expected to become 2 to 4 degrees warmer by mid-century and possibly 4 to 8 degrees warmer by late century, depending on emission levels (ClimateWise, 2010). Greater warming is expected to occur in the summer months compared to winter. Arroyo Grande should also anticipate more heat waves,¹ which could last longer and become three to four times more frequent by 2050. A secondary impact of increased temperatures is poorer air quality, largely due to increased ground level ozone and potentially increased particulate matter levels, and allergens such as pollen, which can affect public health. Elderly persons, children, outdoor workers, and individuals suffering from chronic

¹ The California Adaptation Planning Guide (2012) defines heat waves for inland areas, such as Arroyo Grande, as five or more consecutive days over 99 degrees to 101 degrees Fahrenheit.

heart or lung disease are most vulnerable to public health implications of higher temperatures and heat waves.

Approximately 7 percent of all Arroyo Grande residents live below the poverty line (U.S. Census 2007-2011). With anticipated increases in temperature, these economically disadvantaged persons may find it more difficult to afford the additional costs of cooling their homes. Consequently, many low-income households, especially those of elderly and disabled persons may become physically vulnerable to the effects of extreme heat events.

Increases in temperature could impact the City's economy, as agriculture and construction jobs comprise 8 percent of the City's workforce. Damaged crops and reduced crop yields would lower revenues as well as shrink the demand for agricultural workers. Additionally, increased temperatures and reductions in air quality can lead to hazardous conditions, such as heat stroke and respiratory ailments for agricultural and construction laborers working outdoors.

4.1.2 CHANGED PRECIPITATION

Precipitation, except during winter months, is anticipated to change little in the near future. However, climate models forecast drier conditions throughout San Luis Obispo County by 2075. As a result, droughts may become more frequent, longer and more severe. It is also projected that when rainfall does occur, it may be more likely to come in the form of intense downpours.

Arroyo Grande relies on water from the Lopez Lake Treatment Facility and from city wells. The Arroyo Grande Public Works Department supplies the water for urban use, and a limited number of private wells serve agricultural uses within the city limits. While climate models predict little change in rainfall patterns for the near future, they do forecast a drier climate during the last half of this century. This may result in longer and more severe periods of drought, therefore impacting the livestock and agriculture industry, which rely on annual precipitation for reliable grazing and water for crops. Limited water supplies will affect all water users in the city, particularly those living in rural areas that depend on groundwater alone.

4.1.3 INCREASED FREQUENCY AND SEVERITY OF STORM EVENTS

As mentioned above, the severity of storm events could increase, even if precipitation levels do not. This is an important differentiation to recognize. More rainfall in a shorter timeframe increases the risk of flooding. The prevalence of impermeable paving materials and drainage systems that prevent quick absorption back into the ground will exacerbate the problem.

Businesses, residents, and infrastructure located within floodplains (e.g., adjacent to Arroyo Grande Creek) would be more susceptible to damage or disruption by larger than average precipitation events. The region may see more severe (but not necessarily more frequent) rainfall events, leading to quick pulses of runoff. Currently, there is insufficient infrastructure to accommodate that momentary surplus of water, and large amounts of impervious pavement prevent much of the rain from infiltrating into the ground. There is also a possibility of septic systems and sewage treatment plants being unable to handle increases in intense rainfall events and associated runoff. This could impede the proper functioning of onsite septic systems or overwhelm sewers and centralized sewage treatment plants. As a result, untreated water,

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with a full load of toxics and organic waste, could enter streams and coastal waters (Koopman et al., 2010).

4.1.4 INCREASED BURN AREA FROM WILDFIRES

Rural areas within and surrounding Arroyo Grande may become more prone to wildfires due to higher temperatures and stress to vegetation. By the end of the century, San Luis Obispo County could experience two to three times larger area burned annually by wildfires (ClimateWise, 2010).

As the population and urban areas of the state continue to grow, much of California is experiencing an exponential increase in its vulnerability to wildfire damages and loss. This increase is especially true in outlying (rural) suburbs that are situated in forested or brush covered areas seen as more desirable than higher density developments. Because rural properties are more likely to be more than 1,000 feet from a hydrant, firefighting capabilities are not as effective for such properties.

4.2 Adaptation Measures

The following measures focus on items the City of Arroyo Grande can implement in adapting to climate change. The goal of these measures is to reduce impacts to the community, the economy, and local natural resources. Recognizing the link between public health and climate adaptation, this chapter recommends adaptation measures that are designed to reduce the negative impacts of climate change on sensitive populations and communities. Measures were developed from those identified in the ClimateWise program, the World Bank Primer on Reducing Vulnerabilities to Disaster, International Council for Local Environmental Initiatives (ICLEI), and the California Natural Resources Agency's Climate Adaptation Strategy.

Measure A-1: Climate Change Vulnerability

Identify and periodically reassess regional climate change vulnerabilities.

Implementation Actions:

- **A-1.1:** Participate in inter-agency and or inter-jurisdictional meeting and planning activities to identify and periodically reassess regional climate change vulnerabilities.
- **A-1.2:** Incorporate newly identified adaptation measures into planning documents as appropriate.

Measure A-2: Public Health and Emergency Preparedness

Prepare for anticipated climate change effects on public health, the local economy, and populations that may bear a disproportionate burden of the climate change effects.

Implementation Actions:

- **A-2.1:** Collaborate with community-based organizations (such as health care providers, public health advocates, fire prevention organizations, etc.) to disseminate public preparedness and emergency response information related to climate change.
- **A-2.2:** Conduct training exercises at public forums as well as distribute publicly available information on emergency exit routes and methods.
- **A-2.3:** Identify and focus planning and outreach programs on vulnerable populations including neighborhoods that currently experience social or environmental injustice or bear a disproportionate burden of potential public health impacts.
- **A-2.4:** Prepare a heat wave response plan that focuses on responding to the increased propensity for heat-related death and illness.
- **A-2.5:** Coordinate and promote cooling centers for residents who may require refuge from hot days, particularly low-income households and senior citizens.²
- **A-2.6:** Coordinate with the City's Fire and Police Departments to bolster wildfire preparedness and defensiveness for residents and businesses through providing information on the City's website and conducting trainings promoting mechanical fuel management and increasing the area of defensible space around structures.

Measure A-3: Water Management

Implement new policies and programs to limit community exposure to threats such as flooding, and support those that encourage water use conservation and efficiency.

Implementation Actions:

- **A-3.1:** Collaborate with other jurisdictions to address water supply threats, flooding, and wastewater management.
- **A-3.2:** Continue to seek grants and other sources of funding, including the State Integrated Regional Water Management Grant Program and mitigation opportunities, to enhance flood control and improve water quality.

Measure A-4: Infrastructure

Work to improve the resilience of systems that provide the resources and services critical to community function.

Implementation Actions:

- **A-4.1:** Assess the potential impact of climate change as part of the update of plans that manage community infrastructure systems.

² A cooling center is a place where residents can go to cool off on high heat days. Cooling centers are often located in local government-run facilities such as senior centers or neighborhood parks and recreation sites and are open to all. Typical locations include community centers, fairgrounds, libraries, and other public facilities (California Adaptation Planning Guide, 2012).

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- **A-4.2:** Complete an assessment, including economic impacts and threats to public health and safety, for projected climate change impacts on local transportation, water, wastewater, stormwater, energy, and communication systems.
- **A-4.3:** Develop mitigation plans for protection of the wastewater treatment facility, the high school, and the relocation or elevation of vulnerable infrastructure.

CHAPTER 5

IMPLEMENTATION AND MONITORING

5.0 Implementation and Monitoring

Implementation and monitoring are essential components of the CAP to ensure that Arroyo Grande reduces its GHG emissions and meets its target. This chapter identifies key steps that the City will take to implement the CAP and monitor the progress in reducing Arroyo Grande's GHG emissions consistent with AB 32. It also describes potential funding sources and mechanisms available to implement the CAP.

5.1 Implementation Matrix

Ensuring that the CAP measures translate into measurable reductions in GHG emissions is critical to the success of the CAP. To facilitate this, each measure and its corresponding implementation actions identified in Chapter 3, *Climate Action Measures*, and Chapter 4, *Adaptation*, is listed in the implementation matrix in **Table 5-1** along with the following items:

- **Responsible Department(s):** The City department that will be primarily responsible for implementing, monitoring, and reporting on the progress of the selected measure and corresponding actions.
- **Implementation Time Frame:** The phase in which this measure should begin implementation. Please note that measures already underway with existing or recently completed efforts in support of the measure are categorized as near-term. Time frames include:
 - Near-Term – By 2015
 - Mid-Term – 2016-2017
 - Long-Term – 2018-2020
- **City Cost and Savings Estimates:** For each measure, potential costs and savings to the City are categorized as none (\$0), very low (\$1-\$10,000), low (\$10,001-\$50,000), medium (\$50,001-\$100,000), and high (\$100,001 or greater). Supporting information on costs and savings is provided in **Appendix B**.
- **GHG Reduction Potential:** The GHG reduction potential value identifies the estimated annual emission reductions anticipated in 2020, measured in MT CO₂e. Supporting information pertaining to the GHG reduction calculations is provided in **Appendix B**.
- **Performance Indicator:** Performance indicators enable the City to generally monitor measure progress.

5.0 IMPLEMENTATION AND MONITORING

Table 5-1: Implementation Matrix

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
Local Government Operations							
C-1: City Government Energy Efficiency Retrofits and Upgrades. Establish a goal to reduce City government energy use by 20 percent by 2020 and implement cost-effective improvements and upgrades to achieve that goal.	<p>C-1.1: Formalize the City government energy use reduction goal of 20 percent.</p> <p>C-1.2: Complete energy audits and benchmarking of all City-owned or -operated facilities, leveraging existing programs, such as PG&E's Automated Benchmarking Service or the U.S. EPA's ENERGY STAR Challenge program.</p> <p>C-1.3: Maintain a regular maintenance schedule for heating and cooling, ventilation and other building functions.</p> <p>C-1.4: Establish a prioritized list of energy efficiency upgrade projects and implement them as funding becomes available.</p>	Public Works	Varies	Medium	48	20 percent energy savings from City government operations by 2020	Near-Term
C-2: City Government Energy Efficient Public Realm Lighting. Continue to replace City-owned or -operated street, traffic signal, park, and parking lot lights	<p>C-2.1: Conduct an inventory of existing outdoor public light fixtures.</p> <p>C-2.2: Continue to identify and secure funding to replace inefficient City-owned or -operated public lighting.</p>	Public Works	Low	Low	7	25 LED street lights, 10 LED traffic signals, and 50 LED or CFL other outdoor lights	Near-Term

5.0 IMPLEMENTATION AND MONITORING

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
with higher efficiency lamp technologies.						installed by 2020	
C-3: Energy Efficiency Requirements for New City-owned Buildings. Adopt a policy to exceed minimum Title 24 Building Energy Efficiency Standards by 20 percent for the construction or renovation of new City buildings and facilities.	C-3.1: Adopt a policy to exceed 2013 Title 24 building efficiency standards by 20 percent.	Building Division	Low	Very Low	8	25,000 new City-owned or -operated building square feet exceeding State standards by 20 percent by 2020	Mid-Term
C-4: Zero- and Low-Emission City Fleet Vehicles. Replace official City vehicles with zero-emission and low-emission vehicles, including smaller, hybrid, electric, compressed natural gas, biodiesel, and neighborhood electric vehicles.	C-4.1: Replace 10 vehicles with zero-emission or low-emission vehicles by 2020.	All City Departments	Medium	Very Low	13	10 municipal vehicles replaced by 2020	Near-Term

5.0 IMPLEMENTATION AND MONITORING

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
C-5: City Government Solid Waste Reduction. Adopt a 15 percent solid waste diversion rate over 2005 baseline levels and identify steps to meet that rate by 2020.	C-5.1: Develop and adopt a City purchasing policy that emphasizes recycled and recyclable materials.	Administrative Services	Low	None	1	15 percent diversion in City solid waste	Near-Term
C-6: City Government Tree Planting Program. Establish a tree planting program to increase the number of native, drought-tolerant trees on City-owned property, parks and streetscapes.	C-6.1: Develop and adopt a formal tree planting policy or program and plant at least 250 trees by 2020. C-6.2: Identify and secure grant funding to plant trees on City properties.	Public Works	Low	None	3	250 net new trees planted on City property by 2020	Mid-Term
Energy							
E-1: Energy Efficiency Outreach and Incentive Programs. Expand participation in and the promotion of existing programs, such as Energy Upgrade California and San Luis Obispo	E-1.1: Conduct additional outreach and promotional activities, either individually or in collaboration with San Luis Obispo County Energy Watch, targeting specific groups or sectors within the community (e.g., homeowners, renters, businesses, etc.). E-1.2: Designate one week per	Planning Division, Building Division	Very Low	None	141	25 percent of households participating with 5 percent energy savings and 30 percent of	Mid-Term

5.0 IMPLEMENTATION AND MONITORING

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
County Energy Watch, and develop new incentives to increase community awareness of existing energy efficiency rebates and financial incentives.	<p>year to conduct an energy efficiency outreach campaign targeting a specific group. The campaign week can also be used to recognize and encourage programs and educational outreach conducted by industry organizations, non-governmental entities, government agencies, and other community groups.</p> <p>E-1.3: Direct community members to existing program websites, such as Energy Upgrade California and San Luis Obispo County Energy Watch.</p> <p>E-1.4: Work with the County of San Luis Obispo and other partners to offer increased incentives to residential and commercial property owners to install energy efficiency retrofit improvements.</p>					businesses participating with 6 percent energy savings by 2020	
E-2: Energy Audit and Retrofit Program. Facilitate voluntary energy assessments, retrofits, and retrocommissioning of residential and commercial buildings	<p>E-2.1: Collaborate with San Luis Obispo County Energy Watch, local utilities, and local jurisdictions to develop and promote a residential and commercial energy audit program.</p> <p>E-2.2: Conduct outreach and promotional activities targeting</p>	Building Division, Planning Division	Very Low	None	151	250 households and 100 businesses audited by 2020, with an average energy savings of	Mid-Term

5.0 IMPLEMENTATION AND MONITORING

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
within Arroyo Grande.	<p>specific groups (e.g., owners of buildings built prior to Title 24 [1980]) in order to promote the audit and retrofit program.</p> <p>E-2.3: As part of the business licensing and renewal process, encourage businesses to participate in the program and receive an energy audit.</p> <p>E-2.4: Participate in and promote an energy efficiency financing program to encourage investment in residential and commercial energy efficiency building upgrades.</p> <p>E-2.5: Work with Energy Upgrade California, local utilities, and/or community businesses and organizations, to annually conduct a "do-it-yourself" workshop for building energy retrofits.</p> <p>E-2.6: Highlight the effectiveness of energy audits and retrofits by showcasing the success of retrofit projects (e.g., on the City's website or in its newsletter).</p>					15 percent per retrofit	
E-3: Income-Qualified Energy	E-3.1: Facilitate and promote existing income-qualified	Planning Division,	Very Low	None	126	100 residential	Near-Term

5.0 IMPLEMENTATION AND MONITORING

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
Efficient Weatherization Programs. Facilitate energy efficient weatherization of low- and middle-income housing through promotion of existing programs.	weatherization programs, such as PG&E's Middle Income Direct Install program, either individually or by partnering with a local organization.	Building Division, Administrative Services				units upgraded by 2020	
E-4: Energy Conservation Ordinance. Require through a new City ordinance that cost-effective energy efficiency upgrades in existing buildings be implemented at point of sale or during major renovation of residential units. A maximum cost ceiling would be established to protect owners from excessive fees.	E-4.1: Develop and adopt a local residential energy conservation ordinance, including establishment of a maximum cost ceiling.	Building Division, Planning Division	Low	None	621	700 residential units and 100 non-residential units retrofitted by 2020, with an average energy savings of 15 percent per retrofit	Mid-Term
E-5: Incentives for Exceeding Title 24 Energy Efficiency Building Standards. Provide incentives (e.g., priority	E-5.1: Collaborate with community organizations and businesses, local utilities, and other local jurisdictions in the region to develop and promote a technical assistance and best	Building Division, Planning Division	Very Low	None	117	100 new or remodeled residences and 50 new non-residential	Mid-Term

5.0 IMPLEMENTATION AND MONITORING

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
permitting, reduced permit fees, etc.) for new development and/or major remodels that voluntarily exceed State energy efficiency standards by 20 percent.	<p>practices program that aids developers in selecting and implementing energy efficiency measures that exceed State standards.</p> <p>E-5.2: Identify, provide and promote incentives (e.g., expedited or streamlined permitting, deferred fees, public recognition, etc.) for applicants whose project exceeds State requirements by 20 percent.</p> <p>E-5.3: Update building permit process to incentivize higher building performance (e.g. buildings that integrate and optimize major high-performance building attributes, including energy efficiency, durability, and life-cycle performance).</p> <p>E-5.4: Launch an educational campaign for builders, permit applicants, and the general public to promote best practices and incentive programs; provide information and assistance about energy efficiency options online and at permit counter.</p>					buildings exceeding State standards by 20 percent by 2020	
E-6: Energy Efficient Public Realm Lighting	E-6.1: Develop and adopt an ordinance that requires new development to utilize high	Planning Division	Very Low	Very Low	8	100 private LED streetlights	Near-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
Requirements. Require through a new City ordinance that new development utilize high efficiency lights in parking lots, streets, and other public areas.	efficiency lights in parking lots, streets, and other public areas.					and 200 LED or CFL other outdoor lights installed by 2020	
E-7: Small-Scale On-Site Solar PV Incentive Program. Facilitate the voluntary installation of small-scale on-site solar PV systems and solar hot water heaters in the community through expanded promotion of existing financial incentives, rebates, and financing programs, and by helping the average resident and business overcome common regulatory barriers and upfront capital costs.	<p>E-7.1: Collaborate with other local jurisdictions in the region to standardize requirements across jurisdiction, by using common promotion and permit materials, such as checklists and standard plans, to reduce permit submittal errors among contractors working throughout a region.</p> <p>E-7.2: Participate in and promote a renewable energy financing program for residential and non-residential property owners.</p> <p>E-7.3: Expand education on and promotion of existing incentive, rebate, and financing programs for small-scale on-site solar PV systems and solar hot water heaters targeting specific groups or sectors within the community.</p>	Building Division, Planning Division	Very Low	None	439	20 commercial solar PV systems installed, 185 residential solar PV systems installed, and 75 residential solar water heater installed by 2020	Long-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
E-8: Income-Qualified Solar PV Program. Facilitate the installation of small-scale on-site solar PV systems on and solar hot water heaters in income-qualified housing units by promoting existing programs offered through the California Solar Initiative and New Solar Homes Partnership and by collaborating with organizations, such as Grid Alternatives, on outreach and eligibility.	<p>E-8.1: Collaborate with Grid Alternatives and other community organizations to provide targeted education and outreach to developers and homeowners about incentives offered through the Multifamily Affordable Solar Homes (MASH) Program.</p> <p>E-8.2: Provide targeted outreach regarding solar water heating incentives offered through the California Solar Initiative.</p>	Building Division, Planning Division	Very Low	None	139	104 low-income residential solar PV systems installed and 25 low-income residential solar water heaters installed by 2020	Mid-Term
Transportation and Land Use							
TL-1: Bicycle Network. Continue to improve and expand the City's bicycle network and infrastructure.	<p>TL-1.1: Continue to pursue public and private funding to expand and link the City's bicycle network in accordance with the General Plan and Bicycle Plan.</p> <p>TL-1.2: Collaborate with the San Luis Obispo Bicycle Coalition to assist with event promotions and publications to increase</p>	Engineering Division, Planning Division	Very Low	None	140	2 miles of new bike lane added by 2020	Near-Term

5.0 IMPLEMENTATION AND MONITORING

Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
	awareness and ridership during Bike Month.						
TL-2: Pedestrian Network. Continue to improve and expand the City's pedestrian network.	TL-2.1: Continue to pursue public and private funding to expand and link the City's pedestrian network. TL-2.2: Continue to expand and promote the Safe Routes to School program.	Planning Division, Engineering Division	None	None	119	4 miles of new sidewalk added by 2020	Near-Term
TL-3: Transit Travel. Work with the Regional Transit Authority (RTA) and South County Transit to increase transit ridership.	TL-3.1: Coordinate with RTA and South County Transit to facilitate the use of transit by increasing its safety, cleanliness, and accessibility. TL-3.2: Through the development review process, require new development to provide safe and convenient access to public transit within and/or contiguous to the project area as feasible.	Planning Division	Very Low	None	Supportive (GHG reductions from this measure are supportive of and grouped under Measure TL-7)	NA	Near-Term
TL-4: Transportation Demand Management (TDM) Incentives. Work with San Luis Obispo Regional Ride Share and Ride-On to conduct additional outreach and	TL-4.1: Conduct additional outreach through event promotions and publications, targeting specific groups or sectors within the community (e.g., employers, employees, students, seniors, etc.). TL-4.2: Provide information on and promote existing employer based TDM programs as part of	Planning Division, City Manager	Very Low	None	35	15 percent of employees participating in TDM programs	Mid-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
marketing of existing TDM programs and incentives to discourage single-occupancy vehicle trips and encourage alternative modes of transportation, such as carpooling, taking transit, walking, and biking.	<p>the business licensing and renewal process.</p> <p>TL-4.3: Continue to collaborate with San Luis Obispo Ride Share and the San Luis Obispo Bicycle Coalition to assist with event promotions and publications to increase awareness and ridership during Bike Month and Rideshare month.</p> <p>TL-4.4: Direct community members to existing program websites (e.g., Ride Share, Ride-On) by providing links on the City's website.</p>						
TL-5: Parking Supply Management. Reduce parking requirements in areas such as the downtown where a variety of uses and services are planned in close proximity to each other and to transit.	TL-5.1: Continue to implement reduced parking requirements where appropriate.	Planning Division	Very Low	None	19	Net reduction of 100 parking spaces by 2020	Mid-Term
TL-6: Electric Vehicle Network and Alternative Fueling Stations.	TL-6.1: Continue to develop and implement the electric vehicle readiness plan through expanding the use of alternative	Building Division, Planning Division,	Very Low	None	1,056	5 percent increase in electric vehicles by	Near-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
Continue to work with the APCD, Central Coast Clean Cities Coalition, and neighboring jurisdictions to create and implement the electric vehicle readiness plan.	<p>fuel vehicles and fueling stations in the community (e.g., through identifying and zoning locations for fueling stations, offering incentives for alternative fuel vehicles, etc.).</p> <p>TL-6.2: Provide streamlined installation and permitting procedures for vehicle charging facilities, utilizing tools provided in the electric vehicle readiness plan (e.g., sample charging permits, model ordinances, development guidelines, outreach programs).</p> <p>TL-6.3: Continue to pursue funding for plug-in electric vehicle charging stations.</p>	Public Works				2020	
TL-7: Smart Growth. Identify and implement additional incentives to encourage mixed-use, higher density, and infill development near existing or planned transit stops, in existing community centers/downtown, and in other designated areas.	<p>TL-7.1: Provide and promote incentives (e.g., parking reductions, priority permitting, etc.) for mixed-use and very high-density development that has a minimum density of 20 dwelling units per acre and is located within ¼-mile of an existing or planned transit stop or park and ride facility with regularly scheduled, daily service.</p> <p>TL-7.2: Develop a form-based</p>	Planning Division	Very Low	None	1,731	25 percent of new residential units and new jobs located within ¼-mile of transit, and a 5 percent reduction in VMT by 2020	Mid-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
	zoning code for the central business district/downtown. Form-based codes emphasize building form rather than use. This increases flexibility for a variety of complementary uses to be permitted in the same area, and the potential for mixed-use development, which helps to reduce vehicle miles traveled.						
Off-Road							
O-1: Off-Road Vehicle and Equipment Upgrades, Retrofits, and Replacements. Continue to work with the APCD and promote existing programs that fund off-road vehicle and equipment upgrades, retrofits, and replacement through the Carl Moyer heavy-duty vehicle and equipment program or other funding mechanisms.	O-1.1: Conduct additional outreach and promotional activities targeting specific groups (e.g., agricultural operations, construction companies, homeowners, etc.). O-1.2: Direct community members to existing program websites (e.g., APCD, Carl Moyer Grant page).	Public Works, Planning Division	Very Low	None	440	10 percent of off-road equipment replaced with electric equipment and 10 percent of off-road equipment replaces with alternative fuels by 2020	Mid-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
Solid Waste							
S-1: Recycling at Public Events. The City would adopt an ordinance requiring the provision of recycling receptacles at all events requiring a permit or held on City-owned or - operated property.	S-1.1: Develop and adopt an event recycling ordinance.	Recreation Services	Very Low	None	3	90 percent of solid waste recycled at public events	Near-Term
Tree Planting							
T-1: Tree Planting Program. Develop a program to facilitate voluntary tree planting within the community, working with local non-profit organizations and community partners. Develop and adopt tree planting guidelines that address tree and site selection.	T-1.1: Develop a tree planting assistance program. T-1.2: Develop and adopt tree planting guidelines that address tree and site selection. Emphasis should be placed on native, drought-tolerant trees.	Public Works	Low	None	6	500 net new trees planted by 2020	Near-Term
Adaptation							
A-1: Climate Change Vulnerability. Identify and periodically reassess regional	A-1.1: Participate in inter-agency and or inter-jurisdictional meeting and planning activities to identify and periodically reassess	Planning Division	Very Low	None	NA	NA	Mid-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
climate change vulnerabilities.	<p>regional climate change vulnerabilities.</p> <p>A-1.2: Incorporate newly identified adaptation measures into planning documents as appropriate.</p>						
A-2: Public Health and Emergency Preparedness. Prepare for anticipated climate change effects on public health, the local economy, and populations that may bear a disproportionate burden of the climate change effects.	<p>A-2.1: Collaborate with community-based organizations (such as health care providers, public health advocates, fire prevention organizations, etc.) to disseminate public preparedness and emergency response information related to climate change.</p> <p>A-2.2: Conduct training exercises at public forums as well as distribute publicly available information on emergency exit routes and methods.</p> <p>A-2.3: Identify and focus planning and outreach programs on vulnerable populations including neighborhoods that currently experience social or environmental injustice or bear a disproportionate burden of potential public health impacts.</p> <p>A-2.4: Prepare a heat wave</p>	Five Cities Fire Authority, Planning Division	Very Low	None	NA	NA	Mid-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
	<p>response plan that focuses on responding to the increased propensity for heat-related death and illness.</p> <p>A-2.5: Coordinate and promote cooling centers for residents who may require refuge from hot days, particularly low-income households and senior citizens.</p> <p>A-2.6: Coordinate with the City's Fire and Police Departments to bolster wildfire preparedness and defensiveness for residents and businesses through providing information on the City's website and conducting trainings promoting mechanical fuel management and increasing the area of defensible space around structures.</p>						
A-3: Water Management. Implement new policies and programs to limit community exposure to threats such as	<p>A-3.1: Collaborate with other jurisdictions to address water supply threats, flooding, and wastewater management.</p> <p>A-3.2: Continue to seek grants and other sources of funding, including the State Integrated</p>	Public Works, Planning Division	Very Low	None	NA	NA	Near-Term

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Measure	Actions	Responsible Department	City Cost	City Savings	2020 GHG Reduction (MT CO ₂ e)	Performance Indicator	Implementation Time Frame
flooding, and support those that encourage water use conservation and efficiency.	Regional Water Management Grant Program and mitigation opportunities, to enhance flood control and improve water quality.						
Measure A-4: Infrastructure. Work to improve the resilience of systems that provide the resources and services critical to community function.	A-4.1: Assess the potential impact of climate change as part of the update of plans that manage community infrastructure systems. A-4.2: Complete an assessment, including economic impacts and threats to public health and safety, for projected climate change impacts on local transportation, water, wastewater, stormwater, energy, and communication systems. A-4.3: Develop mitigation plans for protection of the wastewater treatment facility, the high school, and the relocation or elevation of vulnerable infrastructure.	Public Works, Five Cities Fire Authority, Planning Division, Building Division, Engineering Division, Administrative Services, City Manager	Very Low	None	NA	NA	Long-Term

5.2 Implementation and Monitoring Policies

CAP implementation and monitoring will require City leadership to execute CAP measures and actions, report on the progress of implementation and performance, and if necessary, alter or amend the CAP in the future to ensure that the plan remains effective and on track toward meeting its target. The following policies and actions were developed to guide CAP implementation and monitoring.

I-1: CAP Implementation Team

Establish a CAP Coordinator and multi-departmental CAP Implementation Team to implement, monitor, and report on the status of measures and actions identified in the CAP. The CAP Implementation Team will meet at least one time per year to assess the status of City efforts.

Implementation Actions:

- **I-1.1:** Form a multi-departmental CAP Implementation Team that meets annually to implement, monitor, and report on the status of measures and actions identified in the CAP.
- **I-1.2:** Designate a City staff member on the CAP Implementation Team to have lead responsibilities for overseeing CAP implementation and monitoring. Duties of this position include coordinating the CAP Implementation Team meetings, preparing the annual CAP progress report to City Council, and coordinating the GHG emissions inventory and CAP updates, as specified in this chapter.
- **I-1.3:** Provide CAP implementation and GHG reduction training to staff.

I-2: CAP Measure Evaluation

Annually monitor and report on the implementation and performance of the CAP measures and actions.¹

Implementation Actions:

- **I-2.1:** Prepare an annual progress report for City Council review and consideration. The progress report should:
 - Identify the implementation status of each measure (including how new development projects have been implementing CAP measures);

¹ While a full GHG emissions inventory is necessary to assess community-wide and local government progress toward the 2020 goal, the City can track progress between inventories and provide insight on the effectiveness of specific actions. By evaluating whether the implementation of a measure is on track to achieve its performance criteria, the City can identify successful measures, and re-evaluate or replace under-performing measures.

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- Evaluate achievement of or progress toward performance criteria;²
- Assess the effectiveness of measures included in the CAP;
- Report on the State's implementation of state-level measures included in the CAP; and
- Recommend adjustments to actions or tactics, as needed.

I-3: GHG Emissions Inventory and CAP Updates

Re-inventory GHG Emissions every five years to evaluate the performance of the CAP as a whole, and if necessary, alter or amend the CAP to ensure that the plan remains on track.³

Implementation Actions:

- **I-3.1:** Conduct a GHG inventory every five years and evaluate CAP performance.
- **I-3.2:** Update the CAP as necessary based on the results of the inventory, and to reflect new programs or policies to reduce GHG emissions.

At this time, the State has not created a mandate for further reductions beyond the 2020 target. It has identified a long-term goal for State agencies of reducing emissions to 80 percent below 1990 emissions levels by 2050 (in Executive Order S-3-05), but has not adopted the target and does not plan for meeting this goal. As such, this CAP does not identify a target beyond 2020. As the year 2020 approaches, the State is likely to adopt a target for later years and, at that time Arroyo Grande will adopt a reduction target for a later year consistent with the State's longer-term target. However, if the State has not adopted a reduction target by 2020, the City will set a reduction target based on the State's long-term reduction trajectory.

5.3 Funding Sources

One of the main barriers to an implementation and monitoring plan is lack of available funds. There are multiple grant and loan programs through state, federal, and regional sources to reduce GHG emissions. This section identifies potential funding sources that Arroyo Grande could pursue to offset the financial cost of implementing the CAP measures.

The spectrum of public and private funding options for the measures outlined in this CAP is ever evolving. The programs listed below represent the current (2013) status of those options that are most relevant to the CAP. These funding sources could quickly become out-of-date; therefore, it is important to evaluate the status of a given program before seeking funding, as availability and application processes are updated periodically. In addition, there are general sources of funding that provide the most up-to-date information and should be reviewed on a regular basis, including:

² The performance indicators, provided for each quantified measure, identify the level of participation or performance required to achieve the estimated level of GHG emissions reductions by 2020.

³ Inventory updates provide the best indication of CAP effectiveness as they will allow for comparison to the 2005 baseline. If an update reveals that the plan is not making progress toward meeting the GHG reduction target, the City will adjust the measures as necessary.

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- U. S. Department of Energy
- U.S. Environmental Protection Agency
- U.S. Department of Housing and Urban Development
- California Energy Commission
- California Strategic Growth Council
- California Public Utilities Commission
- Caltrans
- CAL FIRE
- California Statewide Communities Development Authority
- Foundation for Renewable Energy and Environment
- SLOCOG
- SoCalGas
- PG&E

To reduce costs and improve the CAP's effectiveness, actions should be pursued concurrently whenever possible. Funding sources the City decides to pursue will be identified as implementation occurs.

The City can, in part, provide funding for various measures outlined in this CAP. This can be accomplished through the City's annual budgeting and Capital Improvement Program process which provides an opportunity for citizen input and guides decision-makers while helping them set priorities. The City can also partner with SLOCOG, local jurisdictions within San Luis Obispo County, community-based organizations, and private companies for joint programs.

5.3.1 ENERGY-RELATED FUNDING SOURCES

Many of the financing and incentive programs relevant to the CAP concern energy infrastructure and conservation. Some of these programs are tied to the American Recovery Reinvestment Act economic stimulus package enacted by Congress in February 2009. Access to these funds will be available for a limited period. The City should seek the most up-to-date information regarding the programs listed below.

Strategic Growth Council Sustainable Communities Planning Grant Program

California Strategic Growth Council

On behalf of the Strategic Growth Council, the Department of Conservation manages competitive grants to cities, counties, and designated regional agencies to promote sustainable community planning and natural resource conservation. The grant program supports development, adoption, and implementation of various planning elements. The Sustainable Communities Planning Grant Program offers a unique opportunity to improve and sustain the wise use of infrastructure and natural resources through a coordinated and collaborative approach.

Urban Greening for Sustainable Communities Grant Program

California Strategic Growth Council

Because of the built-out nature of California's urban areas, the Urban Greening for Sustainable Communities Program provides funds to preserve, enhance, increase, or establish community green areas such as urban forests, open spaces, wetlands, and community spaces (e.g.,

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community gardens). The goal is for these greening projects to incrementally create more viable and sustainable communities throughout the state. This program has both an Urban Greening Planning Program, which provides funds to assist entities in developing a master urban greening plan, and an Urban Greening Project Program, which provides funds for projects that preserve, enhance, increase or establish community green areas.

Urban and Community Forestry Grant Program

CAL FIRE

The CAL FIRE Urban and Community Forestry Program works to expand and improve the management of trees and related vegetation in communities throughout California. This program offers funding through a variety of grants. The Urban Forest Management Plan Grant funds the development and implementation of a management plan to be used by a jurisdiction to manage its urban forest. Such plans will be holistic and long-term, must include the entire jurisdiction and take an ecosystem management approach, and may include a minimum level of a training or educational component. Local jurisdictions may request between \$30,000 and \$100,000 and matching contributions totaling 25 percent of the total project cost is required. The Green Trees for the Golden State Grant provides funding for urban tree planting projects and up to two years of initial maintenance. Local jurisdictions may request between \$30,000 and \$100,000. Matching contributions totaling 25 percent of the total project cost is required.

California Investor Owned Utilities (IOUs) Programs

PG&E

California IOUs, such as PG&E, are required by the CPUC to offer energy efficiency programs to their customers. Each IOU program is unique; generally the programs offer rebates, financing assistance, design assistance, educational seminars, and other forms of assistance. PG&E's rebates may be calculated based on the amount of energy savings or, alternatively, may be fixed rate financial assistance for specific energy efficiency technology.

In conjunction with its rebates and incentives programs, PG&E offers an Energy-Efficiency Retrofit Loan Program, also known as On-Bill Financing. The program for public agencies includes: zero-percent financing on qualifying measures for up to ten years; offsets to energy-efficient upgrade costs after rebates and incentives through PG&E; loans ranging from a minimum of \$5,000 up to \$250,000 per meter; and loan installments added to monthly PG&E bills.

PG&E also offers the Green Communities and Innovator Pilots energy efficiency programs, which are administrated by PG&E, using funds from the Public Goods Charge (PGC) authorized by the California Public Utility Commission (CPUC). Customers of California's three largest investor-owned utility companies pay the PGC through their electric utility bills. Customers pay the surcharge per unit of consumption (kilowatt-hours). Money raised by the PGC is spent on services and programs deemed to be in the public interest, including energy efficiency initiatives such as Green Communities and Innovator Pilots.

SoCalGas

Southern California Gas Company offers On-Bill Financing with rebates for energy efficient natural gas equipment. For institutional customers, such as the City of Arroyo Grande, zero-

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percent financing is available from \$5,000 to \$250,000 per meter, with a maximum payback period of 10 years. Monthly loan payments are added directly to the customer's energy bill.

Energy Conservation Assistance Account Program (ECAA) Energy Efficiency Financing *California Energy Commission*

The California Energy Commission offers low-interest loans (1-3 percent) to help local jurisdictions and other public agencies finance energy-efficient projects as part of the ECAA Program. Projects with proven energy and/or capacity savings are eligible, provided they meet the eligibility requirements. Examples of projects include: lighting systems, pumps and motors, energy efficient streetlights and traffic signals, automated energy management systems/controls, building insulation, renewable energy generation and combined heat and power projects, heating and air conditioning modifications, and wastewater treatment equipment. The maximum loan amount is \$3 million per application for 15 years. There is no minimum loan amount.

California Solar Initiative State Rebate Program

California Energy Commission & California Public Utilities Commission

California Solar Initiative will provide over \$2 billion in statewide incentives over the next decade for solar photovoltaic systems, as well as other solar thermal generating technologies, such as water heaters, on existing residential homes, and existing and new commercial, industrial, and agricultural properties. Photovoltaic incentives are available for systems up to one megawatt in size for homeowners, commercial/industrial, government and non-profit customers. The program pays solar consumers an incentive based on system performance.

California Feed-In Tariff

The California feed-in tariff allows eligible customer-generators to enter into 10-, 15- or 20-year standard contracts with their utilities to sell the electricity produced by small renewable energy systems -- up to three megawatts -- at time-differentiated market-based prices. Time-of-use adjustments will be applied by each utility and will reflect the increased value of the electricity to the utility during peak periods and its lesser value during off-peak periods. These tariffs are not available for facilities that have participated in the California Solar Initiative, Self-Generation Incentive Program, Renewables Portfolio Standard, or other ratepayer funded generation incentive programs, including net-metering tariffs. For customers generating renewable energy not covered by the California Solar Initiative or Self-Generation Incentive Program (e.g., biomass or geothermal) the feed-in tariff is applicable. If customers prefer a long-term contract at a fixed price over a financial incentive paid in the short term, feed-in tariffs may be a beneficial financing tool.

5.3.2 TRANSPORTATION-RELATED FUNDING SOURCES

Many federal, state, and regional grant programs are available to fund transportation and infrastructure improvements. The programs listed below represent the current status of the most relevant of these programs.

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Livability Grant Programs

Federal Transportation Authority

The Federal Transportation Authority provides resources on sustainable communities and transit oriented development. This includes access to transit oriented development resources and training free of charge to local government employees. The Federal Transportation Authority's Livable and Sustainable Communities program supports initiatives that demonstrate ways to improve the link between public transit and communities. The Federal Transportation Authority offers a broad selection of Livability Grant Programs that fund projects for accessible, livable, and sustainable communities. In particular, the Bus and Bus Facilities Discretionary Program provides capital assistance for new buses and intermodal transit centers. The New Starts and Small Starts Program supports transit "guideway" capital investments, such as rapid rail, light rail, commuter rail, automated guideway transit, people movers, bus rapid transit, and other high occupancy vehicles. Additionally, the Intercity Bus Program supports transit access to residents in non-urbanized areas.

Alternative and Renewable Fuel and Vehicle Technology Program

California Energy Commission

Assembly Bill 118 created the Alternative and Renewable Fuel and Vehicle Technology Program, within the California Energy Commission. The statute authorizes the Energy Commission to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's GHG reduction goals and reduce our dependence on foreign oil. The statute allows the Energy Commission to use grants, loans, loan guarantees, revolving loans, and other appropriate measures. Eligible recipients include: public agencies, private businesses, public-private partnerships, vehicle and technology consortia, workforce training partnerships and collaboratives, fleet owners, consumers, recreational boaters, and academic institutions. The Energy Commission must prepare and adopt an Investment Plan and convene an Advisory Committee to assist in preparing the Investment Plan. The Energy Commission has an annual program budget of approximately \$100 million.

Community-Based Transportation Planning Grant Program

Caltrans

The Community-Based Transportation Planning Grant Program is primarily used to seed planning activities that encourage livable communities. Grants assist local agencies to better integrate land use and transportation planning, to develop alternatives for addressing growth, and to assess efficient infrastructure investments that meet community needs. These planning activities are expected to help leverage projects that foster sustainable economies, increase available affordable housing, improve housing/jobs balance, encourage transit oriented and mixed use development, expand transportation choices, reflect community values, and include non-traditional participation in transportation decision making.

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Local Assistance Program

Caltrans

Caltrans' Local Assistance Program oversees more than one billion dollars in federal and state funds annually available to over 600 cities, counties, and regional agencies for the purpose of improving their transportation infrastructure or providing transportation services.

Safe Routes to School Programs

Caltrans

Caltrans administers two separate Safe Routes to School Programs—one state program and one federal program. Both programs are intended to achieve the same basic goal of increasing the number of children walking and bicycling to school by making it safer for them to do so. Both programs fund qualifying infrastructure projects.

Bicycle Transportation Account

Caltrans

The Bicycle Transportation Account is an annual program providing state funds for city and county projects that improve safety and convenience for bicycle commuters. Caltrans expects to appropriate \$7.2 million annually for projects, on a matching basis with local jurisdictions. A wide variety of projects are eligible, including but not limited to new bikeways serving major transportation corridors, new bikeways removing travel barriers, and secure bicycle parking.

Environmental Enhancement and Mitigation Program

Caltrans

The Environmental Enhancement and Mitigation Program offers a total of \$10 million each year for grants to local, state, and federal government agencies and to nonprofit organizations for projects to mitigate the environmental impacts caused by new or modified public transportation facilities. Eligible projects must be directly or indirectly related to the environmental impact of the modification of an existing transportation facility or construction of a new transportation facility. Two of the grant categories include Highway Landscaping and Urban Forestry Projects, which are designed to offset vehicular emissions of carbon dioxide through the planting of trees and other suitable plants, and Roadside Recreation Projects, which provide for the acquisition and/or development of roadside recreational opportunities.

Highway Safety Improvement Program

Caltrans

The Highway Safety Improvement Program provides federal funding for work on any public road or publicly owned bicycle/pedestrian pathway or trail that corrects or improves the safety for its users. The program is intended to reduce traffic fatalities and serious injuries on all public roads. Local jurisdictions, such as counties and cities, may apply to Caltrans for funding ranging from \$100,000 to \$900,000 per project. Federal reimbursements cover up to 90 percent of total project costs. Eligible projects include, but are not limited to, improvements for pedestrian or bicyclist safety, intersection safety improvements, and shoulder widening.

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Community Development Block Grant

California Department of Housing and Community Development

The Community Development Block Grant (CDBG) program funds projects and programs that develop viable urban communities by providing decent housing and a suitable living environment and by expanding economic opportunities, principally for persons of low and moderate income. Federal CDBG Grantees may use funds for activities that include, but are not limited to, acquiring real property; building public facilities and improvements, such as streets, sidewalks, and recreational facilities; and planning and administrative expenses, such as costs related to developing a consolidated plan and managing CDBG funds. The State makes funds available to eligible agencies (cities and counties) through a variety of different grant programs.

Infill Infrastructure Grant Program

California Department of Housing and Community Development

The Infill Infrastructure Grant Program assists in the new construction and rehabilitation of infrastructure that supports higher-density affordable housing and mixed-income housing in locations designated as infill. Eligible applicants include, but are not limited to, localities and public housing authorities.

National Recreational Trails Program

California Department of Parks and Recreation

In California, the National Recreational Trails Program is administered by Department of Parks and Recreation to provide funding to develop recreational trails and related facilities for uses such as bicycling and hiking.

Federal Transportation Improvement Program for the San Luis Obispo County Region

SLOCOG

The Federal Transportation Improvement Program (FTIP) is a comprehensive listing of federally funded surface transportation projects in San Luis Obispo County. SLOCOG prepares and adopts the FTIP every two years in close cooperation with stakeholders such as cities and counties. As part of the FTIP, SLOCOG plans for the spending of flexible funding from the federal Surface Transportation Program, which applies to the following types of projects: enhanced transit services, expanding technology, freeway express bus stops, ridesharing, vanpooling, parallel routes along major transportation corridors, and Park-n-Ride lots. SLOCOG selects projects that promote the strategies and policies of the Regional Transportation Plan.

The FTIP also includes the allocation of funding under the state Transportation Development Act (TDA). Each year, SLOCOG disburses approximately \$10 million in funding from the TDA toward bicycle and pedestrian infrastructure, traffic calming, and other planning and capital improvement projects in the region.

Infrastructure State Revolving Fund Program

California Infrastructure and Economic Development Bank

The Infrastructure State Revolving Fund Program provides low-cost financing to public agencies for a wide variety of infrastructure projects. Program funding is available in amounts ranging

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from \$250,000 to \$10 million, with loan terms of up to 30 years. Interest rates are set on a monthly basis. Eligible project categories include city streets, county highways, state highways, drainage, water supply and flood control, educational facilities, environmental mitigation measures, parks and recreational facilities, port facilities, public transit, sewage collection and treatment, solid waste collection and disposal, water treatment and distribution, defense conversion, public safety facilities, and power and communications facilities.

5.3.3 SOLID WASTE-RELATED FUNDING SOURCES

Beverage Container Recycling Grant and Payment Programs

California Department of Resources Recycling and Recovery (CalRecycle)

CalRecycle administers funding programs to assist organizations with establishing convenient beverage container recycling and litter abatement projects, and to encourage market development and expansion activities for beverage container materials. The Beverage Container Recycling Grant provides funding to local governments, businesses, individuals, and non-profit organizations for projects that implement new programs or enhance existing programs to provide convenient beverage container recycling opportunities in various locations statewide. Eligible projects include, but are not limited to, the following locations: parks and recreational areas, sporting complexes, community events, office buildings, multifamily dwellings, entertainment/hospitality venues, curbside, restaurants, and schools and colleges. CalRecycle issues up to \$1.5 million annually for this program. The City/County Payment Program provides a total of \$10.5 million in grant funds annually to eligible cities and counties for beverage container recycling and litter abatement activities. Each city is eligible to receive a minimum of \$5,000 or an amount calculated by the Department based on per capita, whichever is greater.

5.3.4 OTHER FUNDING SOURCES

Community Assistance Grant

Bureau of Land Management

Funds are available to assist with hazardous fuels treatments, community wildfire protection planning, and education addressing wildfire safety and hazard risk reduction within the wildland-urban interface. Treatments may be focused on both Federal (with prior approval from local Bureau of Land Management field staff) and non-federal lands and aimed toward protecting communities at risk and resource values identified within a Community Wildfire Protection Plan and/or Community Fire Plans with an interdisciplinary and interagency collaborative process.

Wildland Urban Interface Grant

Fish and Wildlife Service

Wildland Urban Interface funds are available for hazard mitigation projects that protect communities at risk of wildfire by reducing hazardous fuels (non-federal lands), developing Community Wildfire Protection Plans (includes associated planning and compliance documents), and implementing wildfire education and outreach initiatives.

5.0 IMPLEMENTATION AND MONITORING

Partnerships with Other Jurisdictions and Community Organizations

Partnering with neighboring jurisdictions and community organizations is a key implementation strategy supporting the CAP. Various jurisdictions and organizations within the County could serve as potential partners in implementing the CAP strategies. The City should seek to partner with appropriate local governments, as identified within CAP measures.

CHAPTER 6

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GLOSSARY

OF TERMS

Glossary of Terms

Actions: The steps that will be taken to implement the Climate Action Plan measures.

Adaptation: The ability to adjust to, or minimize, the potential impacts of climate change or other environmental disturbances.

Baseline Emissions: The amount of GHG emissions released in a designated year against which future changes in emissions levels are measured.

Business-as-Usual: A scenario used for the projection of GHG emissions at a future date based on current technologies and regulatory requirements in absence of other reductions.

California Environmental Quality Act (CEQA): A statute that requires state and local agencies to evaluate the environmental impacts of private or public proposed projects they undertake or permit and to avoid or mitigate potentially impacts, if feasible. If a proposed action has the potential for a significant environmental impact, an environmental impact report (EIR) must be prepared and certified before action can be taken.

Carbon Dioxide (CO₂): A naturally occurring gas, and also a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes. It is the principal anthropogenic GHG that affects the Earth's radiative balance. It is the reference gas against which other GHGs are measured and therefore has a Global Warming Potential of 1.

Carbon Dioxide Equivalent (CO₂e): A metric used to compare the emissions from various greenhouse gases based upon their global warming potential, or potency. Carbon dioxide equivalents are commonly expressed as "metric tons of carbon dioxide equivalents" (MT CO₂e). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated global warming potential. For example, the global warming potential for methane is 21. This means that one metric ton of methane is equivalent to 21 metric tons of carbon dioxide.

Carbon Sequestration: The process through which agricultural and forestry practices remove carbon dioxide from the atmosphere. The term "carbon sinks" is also used to describe agricultural and forestry lands that absorb carbon dioxide.

Chlorofluorocarbons (CFCs): A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere, they drift into the upper atmosphere, where their chlorine components destroy ozone.

Climate: Climate in a narrow sense is usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands of years. The classical period is three decades, as defined by the World Meteorological Organization. These quantities

GLOSSARY OF TERMS

are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

Climate Action Plan: A description of the measures and actions that a local government will take to reduce GHG emissions and achieve an emissions reduction target. Most plans include a description of existing and future year emissions; a reduction target; a set of measures, including performance standards, that will collectively achieve the target; and a mechanism to monitor the plan and require amendment if it is not achieving specified levels. Interchangeable with GHG Reduction Plan.

Climate Change: Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from: natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun; natural processes within the climate system (e.g. changes in ocean circulation); human activities that change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.).

Co-Benefit: Additional benefits that occur as a result of GHG reduction measures. These include financial savings, improved air quality, increased health or safety, natural resource conservation, reduced energy use, etc.

Connectivity: A well connected circulation system with minimal physical barriers that provides continuous, safe, and convenient travel for all users of streets, roads, and highways.

Emissions: The release of a substance (usually a gas when referring to the subject of climate change) into the atmosphere.

Emissions Factor: A set of coefficients used to convert data provided on energy use and energy use reductions to emissions. These emission factors are the ratio of emissions of a particular pollutant (e.g., carbon dioxide) to the quantity of the fuel used (e.g., kilograms of coal). For example, when burned, 1 ton of coal = 2.071 tons of CO₂.

Emissions Forecast: The projected emissions that would occur in a future year based on growth multipliers applied to the baseline year.

Energy Conservation: Reducing energy consumption. Energy conservation can be achieved through energy efficiency (getting the most productivity from each unit of energy) or by reduced use of energy such as turning off appliances when not in use.

Energy Efficiency: Using less energy to provide the same level of service or complete the same task. For example, a more efficient light will use less electricity to provide the same amount of illumination.

Fossil Fuel: A general term for combustible geologic deposits of carbon, including coal, oil, natural gas, oil shale, and tar sands. These fuels emit carbon dioxide into the atmosphere when burned, thus significantly contributing to the enhanced greenhouse effect.

Fuel Efficiency: The distance a vehicle can travel on an amount of fuel. This is most often measured in miles traveled per gallon of fuel. A higher-efficiency vehicle travels farther on a gallon of fuel than similar vehicles.

Global Warming: Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of GHGs.

Green Building: Green, or sustainable, building is the practice of creating and using healthier and more resource-efficient models of construction, renovation, operation, maintenance and demolition.

Greenhouse Effect: Trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. Some of the heat flowing back toward space from the Earth's surface is absorbed by water vapor, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the Earth's surface. If the atmospheric concentrations of these GHGs rise, the average temperature of the lower atmosphere will gradually increase.

Greenhouse Gas (GHG): Any gas that absorbs infrared radiation in the atmosphere. GHGs include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Greenhouse Gas Emissions Inventory: A GHG emissions inventory provides estimates of the amount of GHGs emitted to and removed from the atmosphere by human activities. A city or county that conducts an inventory looks at both community emission sources as well as emissions from government operations. A base year is chosen and used to gather all data from that year. Inventories include data collection from such things as vehicle miles traveled (VMTs), energy usage from electricity and gas, and waste. Inventories include estimates for carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs), which are referred to as the "six Kyoto gases."

Hydrofluorocarbons (HFCs): Man-made compounds containing hydrogen, fluorine, and carbon, many of which have been developed as alternatives to ozone-depleting substances for industrial, commercial, and consumer products, that have a range of global warming potentials. HFCs do not have the potential to destroy stratospheric ozone, but they are still powerful GHGs.

GLOSSARY OF TERMS

Infill Site: A site in an urbanized area that meets criteria defined in Public Resources Code Section 21061.3.

Intergovernmental Panel on Climate Change (IPCC): The IPCC was established jointly by the United Nations Environment Program and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. The IPCC draws upon hundreds of the world's expert scientists as authors and thousands as expert reviewers. Leading experts on climate change and environmental, social, and economic sciences from some 60 nations have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences. With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue. For example, the IPCC organized the development of internationally accepted methods for conducting national GHG emission inventories.

Kilowatt (kW): One thousand watts.

Kilowatt-hour (kWh): an amount of electricity equivalent to the use of one kilowatt for one hour. A hundred watt light bulb that is on for 10 hours uses one kilowatt-hour of electricity (100 watts x 10 hours = 1,000 watt-hours = 1 kilowatt-hour). Electricity production or consumption is often expressed as kilowatt- or megawatt-hours produced or consumed during a period of time.

Methane (CH₄): A hydrocarbon that is a GHG with a global warming potential estimated at 21 times that of carbon dioxide (CO₂). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Measure: A way to reduce GHG emissions.

Metric Ton (MT): Common international measurement for the quantity of GHG emissions. A metric ton is equal to 2,205 pounds or 1.1 short tons.

Mitigation: An action to either reduce the amount of GHGs being emitted into the atmosphere or remove previously emitted gases from the atmosphere.

Mixed-Use: Mixed Use development means combining a variety of compatible land uses in a single development, and can be creatively used to create vibrant centers for living, working, and shopping. The primary purpose of the Mixed-Use land use designations is to implement the principals of smart growth by applying the designation to certain areas along the City's main transportation corridors that could successfully support a combination of uses (multi-family residential, retail, office uses, etc.) within a single development plan.

GLOSSARY OF TERMS

Natural Gas: Underground deposits of gases consisting of 50 to 90 percent methane and small amounts of heavier gaseous hydrocarbon compounds such as propane and butane.

Perfluorocarbons (PFCs): Potent GHGs that accumulate in the atmosphere and remain there for thousands of years. Aluminum production and semiconductor manufacture are the largest known man-made sources of perfluorocarbons.

Recycling: Collecting and reprocessing a resource so it can be used again. An example is collecting aluminum cans, melting them down, and using the aluminum to make new cans or other aluminum products.

Renewable Energy: Energy generated from sources that are naturally replenished or not used up in the course of providing power (e.g., wind, solar, biomass, and geothermal).

Retrofit: The addition of new technology or features to older systems. For example, adding new energy-efficient lamps to existing lighting fixtures.

Sector: A term used to describe GHG emission inventory source categories for GHGs based on broad economic sectors.

Smart Growth: A compact, efficient, and environmentally sensitive pattern of development that provides people with additional travel, housing, and employment choices by focusing future growth closer to existing and planned job centers and public facilities, while preserving open space and natural resources.

Solar Photovoltaic (PV): A system that converts sunlight directly into electricity using cells made of silicon or other conductive materials. When sunlight hits the cells, a chemical reaction occurs, resulting in the release of electricity.

Source: Any process or activity that releases a GHG into the atmosphere.

Target Year: The year by which the GHG emissions reduction target should be achieved.

Transportation Demand Management (TDM): A general term for strategies that increase overall system efficiency by encouraging a shift from single-occupant vehicle trips to non-single-occupant vehicle modes, or shifting auto trips out of peak periods. TDM seeks to facilitate this shift by increasing travel options, by providing incentives and information, or by reducing the physical need to travel through transportation-efficient land uses.

Vehicle-Miles Traveled (VMT): One vehicle traveling the distance of one mile. Total vehicle miles is the aggregate mileage traveled by all vehicles. VMT is a key measure of overall street and highway use. Reducing VMT is often a major objective in efforts to reduce vehicular congestion and achieve air quality goals.

APPENDIX A

GHG EMISSIONS INVENTORY



CITY OF ARROYO GRANDE

Community-Wide and Government Operations Greenhouse Gas Emissions Inventory Update

Prepared for:



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ON BEHALF OF THE CITY OF ARROYO GRANDE

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UPDATED NOVEMBER 2012

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

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Appendices

Appendix A: CACP Detailed Report for Community-Wide Emissions, 2005

Appendix B: CACP Detailed Report for City Government Operations Emissions, 2005

Appendix C: Detailed Methodology for Community-Wide Inventory

Appendix D: Detailed Methodology for City Government Operations Inventory

Appendix E: City Employee Commute Survey, 2009

GREENHOUSE GAS EMISSIONS

INVENTORY UPDATE

Executive Summary

A greenhouse gas (GHG) emissions inventory identifies the major sources and quantities of GHG emissions produced by community activities and City government facilities and operations within a jurisdiction's boundaries for a given year. Estimating GHG emissions enables local governments to establish an emissions baseline, track emissions trends, identify the greatest sources of GHG emissions within their jurisdiction, set targets for future reductions, and create an informed mitigation strategy based on this information.

This Inventory includes a 2005 baseline inventory of GHG emissions from community activities and City government facilities and operations within the city¹, and a 2020 business-as-usual forecast of how emissions in Arroyo Grande would change if no further actions are implemented to reduce those emissions. It is important to note that the City government operations inventory is a subset of the community inventory, meaning that the city government's emissions are included within the community inventory.

The community inventory is divided into six sectors, or sources of emissions: transportation, residential energy use, commercial and industrial energy use, solid waste, off-road vehicles and equipment, and wastewater. The City government inventory provides a more detailed analysis of emissions resulting from City-owned or -operated buildings, fleet vehicles, and lighting; water and sewage transport; City-generated solid waste; and employee commute travel.

GHG EMISSIONS INVENTORY UPDATE

In 2010, PMC prepared an inventory of Arroyo Grande's 2005 community-wide and City government emissions. Changes to GHG accounting protocols have prompted an update to the

What are Greenhouse Gas Emissions (GHGs)?

Gases that trap heat in the Earth's atmosphere are called greenhouse gases, or GHGs. GHGs include carbon dioxide, methane, nitrous oxide, and fluorinated gases. While many of these gases occur naturally in the atmosphere, modern human activity has led to a steep increase in the amount of GHGs released into the atmosphere over the last 100 years. Collectively, these gases intensify the natural greenhouse effect, thus causing global average surface temperatures to rise, which in turn affects global climate patterns. GHGs are often quantified in terms of CO₂ equivalent, or CO₂e, a unit of measurement that equalizes the potency of GHGs.

Source: [Intergovernmental Panel on Climate Change \(IPCC\), 2007](https://www.ipcc.ch/report/ar4/wg1/)

¹ In this report, the term "city" refers to the area inside the jurisdictional boundary of the City of Arroyo Grande, whereas "City government" refers to those activities which are under the operational control of City agencies.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

emissions inventory and in 2012 Rincon Consultants conducted a peer-review and update to the Inventory. This Inventory is the updated assessment of GHG emissions in Arroyo Grande.

Rincon updated the Inventory methodology, emissions coefficients, and data for consistency with current protocols, including the Local Government Operations Protocol (LGOP) version 1.1 (May 2010), for the city government inventory, and the Association of Environmental Professionals California Community-wide GHG Baseline Inventory Protocol (AEP Protocol) (June 2011) and ICLEI International Local Government GHG Emissions Analysis Protocol (IEAP) (October 2009), for the community-wide inventory. Rincon also updated the Inventory to include all emissions sectors within the discretionary action authority of the City. The primary additions and revisions to the updated Inventory include the following:

- Calculation of emissions from additional off-road vehicle and equipment categories (lawn and garden equipment, construction equipment, industrial equipment, and light commercial equipment) for the community-wide inventory.
- Incorporation of improved emissions factors from the LGOP version 1.1.
- Incorporation of a refined methodology for on-road transportation emissions. The 2012 methodology estimates vehicle miles traveled (VMT) based on an origin-destination approach using the regional travel demand model and excludes vehicle trips that pass through the city. Transportation-related GHG emissions were then calculated using the California Air Resources Board Emissions Factor 2011 (EMFAC2011) software.
- Corrections to baseline electricity and natural gas consumption data, and waste stream profile data.
- Inclusion of updated population and employment projections using the San Luis Obispo Council of Governments' (SLOCOG) 2040 Population, Housing & Employment Forecast (August 2011).²

As a result of the Inventory update, Arroyo Grande's community-wide 2005 baseline emissions decreased by 12,150 metric tons CO₂e and 2020 forecast decreased by 23,043 metric tons CO₂e compared to the April 2010 inventory.

² SLOCOG's 2040 Population, Housing & Employment Forecast includes population, housing, and employment projections developed based on an analysis of historic growth and economic trends. See *San Luis Obispo County 2040 Population, Housing & Employment Forecast* (August 2011) for details.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

COMMUNITY-WIDE GHG INVENTORY RESULTS SUMMARY

The community of Arroyo Grande emitted approximately 84,399 metric tons of carbon dioxide equivalent (CO₂e) emissions in the baseline year 2005. As shown in **Figure ES-1**, the transportation sector was the largest contributor to emissions (43.7%), producing approximately 36,897 metric tons of CO₂e in 2005. Transportation sector emissions are the result of diesel and gasoline fuel used in vehicles traveling on local roads and state highways within the jurisdictional boundaries of Arroyo Grande. Emissions from electricity and natural gas consumed in the residential sector were the next largest contributor (29.8%), producing approximately 25,105 metric tons of CO₂e. Electricity and natural gas consumed in commercial and industrial sector accounted for a combined 14.1% of the total, producing 11,932 metric tons of CO₂e. Emissions from landfilled solid waste comprised 7.0% of the total, and emissions from off-road vehicles and equipment comprised 5.4% of the total.

FIGURE ES-1: COMMUNITY GHG EMISSIONS BY SECTOR, 2005

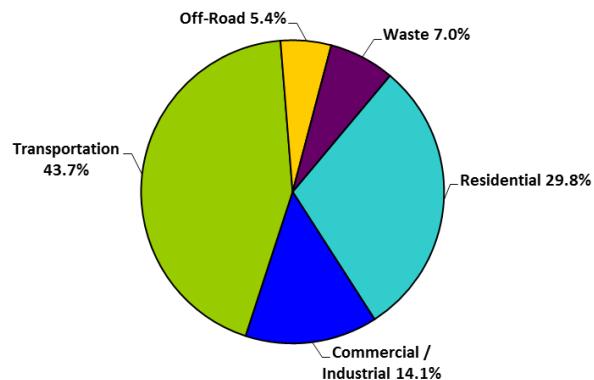


TABLE ES-1: COMMUNITY GHG EMISSIONS BY SECTOR, 2005

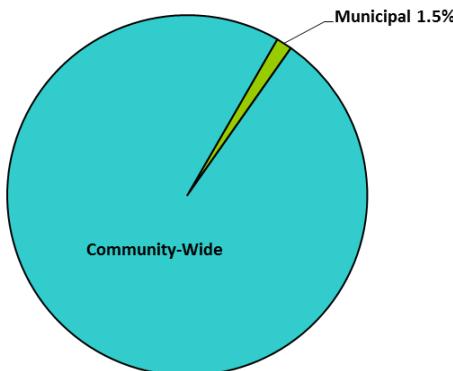
2005 Community GHG Emissions by Sector	Residential	Commercial / Industrial	Transportation	Off-Road	Waste	TOTAL
CO ₂ e (metric tons)	25,105	11,932	36,897	4,556	5,909	84,399
Percentage of Total CO ₂ e	29.8%	14.1%	43.7%	5.4%	7.0%	100%

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CITY GOVERNMENT OPERATIONS GHG INVENTORY RESULTS SUMMARY

City government operations and facilities produced approximately 1,227 metric tons of CO₂e in 2005. As displayed in **Table ES-2** and **Figure ES-2**, this represents approximately 1.5% of total community-wide emissions in the city. City government emissions result from waste, energy consumption from water and wastewater facilities, buildings, streetlights and other facilities, fuel consumption by the vehicle and employee commutes, and miscellaneous equipment. Fuel consumption by the City vehicle fleet was the largest contributor to the City's emissions (28.0%), producing 344 metric tons of carbon dioxide equivalent (refer to **Figure ES-3**). The second largest contributor (20.6%) was from fuel consumption by City employees during their commute to and from work.

**FIGURE ES-2: CITY GOVERNMENT
PORTION OF COMMUNITY-WIDE
GHG EMISSIONS**



**FIGURE ES-3: CITY GOVERNMENT
GHG EMISSIONS
BY SECTOR, 2005**

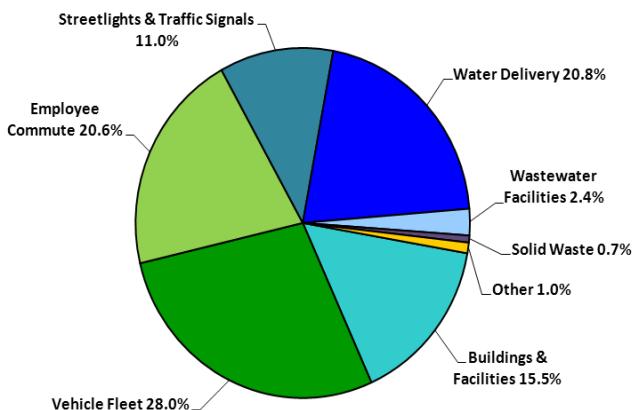


TABLE ES-2: CITY GOVERNMENT GHG EMISSIONS BY SECTOR, 2005

2005 Emissions by Sector	Buildings & Facilities	Vehicle Fleet	Employee Commute	Streetlights & Traffic Signals	Water Delivery	Wastewater Facilities	Solid Waste	Other	TOTAL
CO ₂ e (metric tons)	190	344	253	135	255	30	8	12	1,227
% of CO ₂ e	15.5%	28.0%	20.6%	11.0%	20.8%	2.4%	0.7%	1.0%	100.0%

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City government operations emissions are a subset of the total community-wide emissions as outlined above. However, similar to the way in which businesses and factories perform their own facility-scale GHG Inventories, this Inventory analyzes City emissions separately to identify opportunities for cost-savings and emissions-reductions in the future. The methodology for estimating emissions from local government operations is guided specifically by the LGOP version 1.1 developed by the California Air Resources Board, ICLEI – Local Governments for Sustainability, and the California Climate Registry.

DATA LIMITATIONS

This Inventory captures the major sources of GHGs caused by activities within the City per standard practice and protocol. However, it is important to note that some likely emission sources were not included in the Inventory either because of privacy laws, lack of data, or a lack of reasonable methodology for calculating emissions. It is estimated that the sources not included in the Inventory comprise less than 5.0% of total emissions in the City. It is likely that as GHG inventories become more common, methodology and accessibility to data will improve.

The sources that could not be included due to privacy laws, lack of data availability, and/or a reasonable methodology include the following:

- Refrigerants from City government operations, facilities, and vehicles, and the community-at-large;
- Propane, wind, or solar energy consumed by the community-at-large; and
- Recreational off-road equipment and vehicles.

These limitations are explained in Section 2.5 of this document.

BUSINESS-AS-USUAL FORECAST

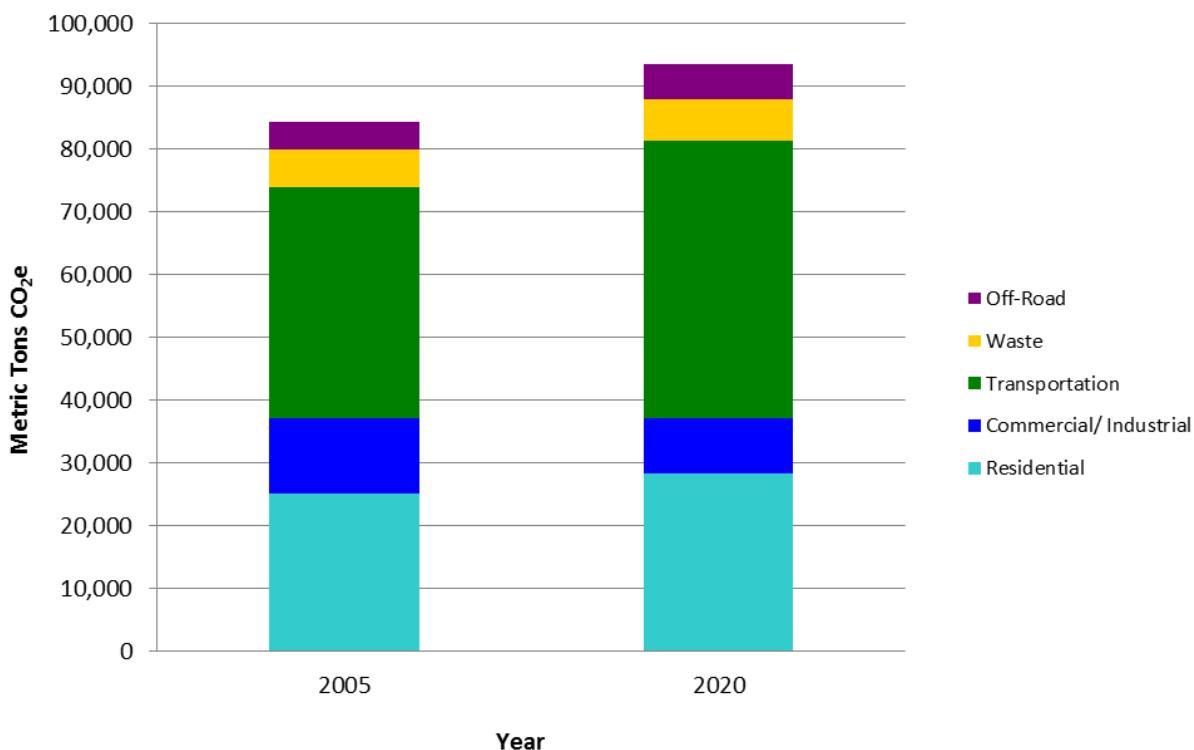
The GHG emissions forecast provides a “business-as-usual estimate,” or scenario, of how emissions would change in the year 2020 if consumption trends continue as they did in 2005, absent any new federal, state, regional, or local policies or actions that would reduce emissions. The year 2020 was selected for the forecast in order to maintain consistency with AB 32.

If consumption trends continue the pattern observed in 2005 and accounting for projected growth in population, employment, and VMT, emissions will reach 93,513 metric tons of CO₂e

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by 2020, or a 10.8% increase over 2005 baseline levels (projections based on population and employment growth).³

**FIGURE ES-4: 2020 CITY OF ARROYO GRANDE
BUSINESS-AS-USUAL GHG EMISSIONS FORECAST**



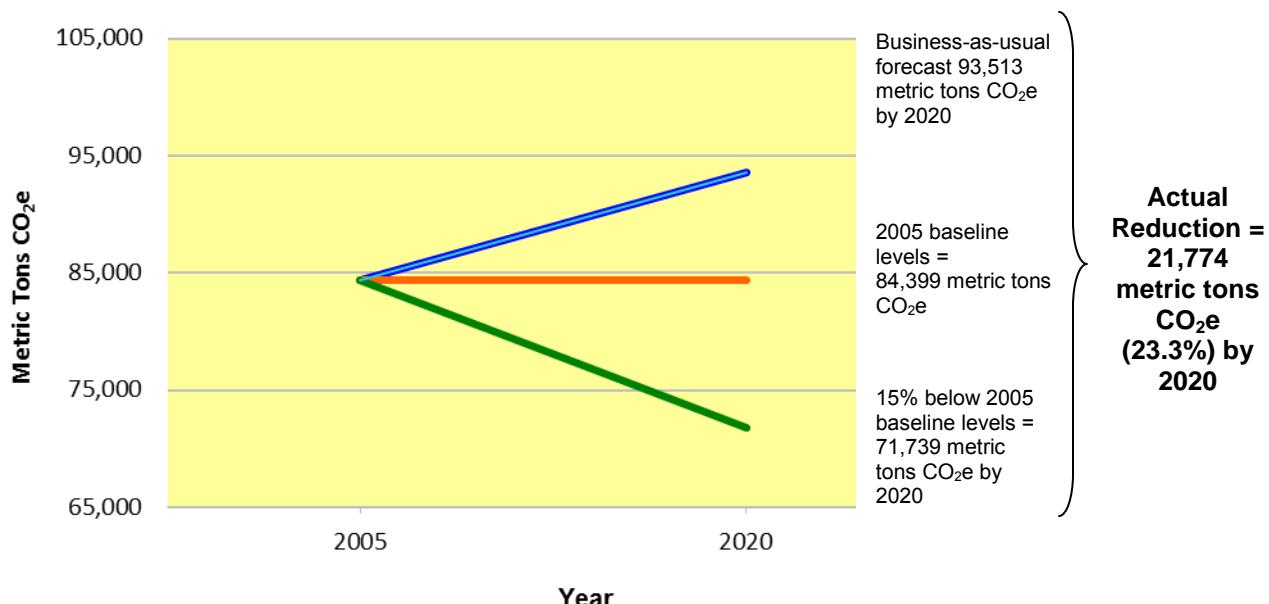
With this information, the City can make an informed determination regarding a reduction target. Conformance with the State of California's recommended reduction of 15% below present levels by 2020 would require a 23.3% reduction below the City's business-as-usual emissions (refer to Figure ES-5).⁴

³ Population and employment projections were obtained from SLOCOG's 2040 Population, Housing & Employment Forecast (August 2011) developed based on an analysis of historic growth and economic trends. VMT projections for the year 2020 were provided by Fehr & Peers (see Appendix C).

⁴ AB 32 Scoping Plan, page 27 states that the California Air Resources Board encourages local governments to "move toward establishing similar goals for community emissions that parallel the State commitment to reduce GHG emissions by approximately 15 percent from current levels by 2020." <http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm>

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**FIGURE ES-5: BUSINESS-AS-USUAL FORECAST IN RELATION TO
STATE-RECOMMENDED REDUCTION TARGET**



GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

1. Introduction

This section introduces the Inventory, defines key terms used throughout the Inventory, and provides an overview of climate change science and regulation in California.

1.1 PURPOSE OF A GHG INVENTORY

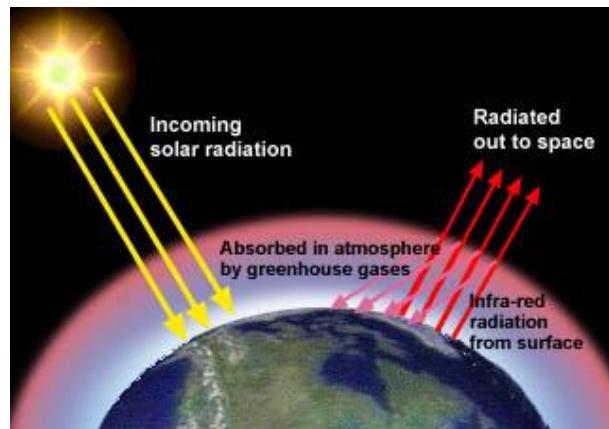
This Inventory represents completion of the first step in the City's climate protection process. Quantifying recent-year emissions is essential to establish: (1) a baseline against which to measure future emission levels, and (2) an understanding of where the highest percentages of emissions are coming from, and, therefore, the greatest opportunities for emissions reductions. This Inventory presents estimates of GHG emissions in 2005 resulting from the community as a whole.

Climate Change – Scientific Background

Scientific consensus holds that the world's population is releasing GHGs faster than the earth's natural systems can absorb them. These gases are released as byproducts of fossil fuel combustion, waste disposal, energy use, land-use changes, and other human activities. This release of gases, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), creates a blanket around the earth that allows light to pass through but traps heat at the surface preventing its escape into space (Figure 1-1). Known as the greenhouse effect, models show that this phenomenon could lead to a 2°F to 10°F temperature increase over the next 100 years. The Intergovernmental Panel on Climate Change (IPCC) warns that most of the warming observed over the last 50 years is attributable to human activities.⁵

Although used interchangeably, there is a difference between the terms "climate change" and "global warming." According to the State, climate change refers to "any long-term change in

**FIGURE 1-1:
THE GREENHOUSE EFFECT**



Source: Tufts University

⁵ Intergovernmental Panel on Climate Change. Fourth Assessment Report, Working Group I. 2007. Climate Change 2007: The Physical Science Basis, Summary for Policy Makers.

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average climate conditions in a place or region, whether due to natural causes or as a result of human activity.⁶ Global warming, on the other hand, is an average increase in the temperature of the atmosphere caused by increased GHG emissions from human activities.⁷ The use of the term climate change is becoming more prevalent because it encompasses all changes to the climate, not just temperature. Additionally, the term climate change conveys temporality, implying that climate change can be slowed with the efforts of local, regional, state, national, and world entities.

Changes in the earth's temperature will have impacts for residents and businesses in the City of Arroyo Grande. Some of the major impacts to the Central Coast expected to occur include the following, separated by sector.^{8, 9}

- **Coastline:** The San Luis Obispo County coastline could face inundation as a result of sea level rise and global warming. As temperatures rise, the ocean waters rise as well due to thermal expansion and the melting of glaciers and snowpack. The state's 2009 Climate Change Impacts Assessment (the 2009 Scenarios Project) estimates that sea levels will rise by 12 to 18 inches by 2050 and 21 to 55 inches by 2100. This level of sea rise has the potential to negatively affect groundwater salination as well as the size and attractiveness of local beaches, which could affect property values and the tourism industry in the County;
- **Reduced Water Supply:** The 2009 Scenarios Project estimates a decrease in precipitation of 12 to 35% by 2050. In addition, more precipitation will fall as rain rather than snow, which will cause snow to melt earlier in the year and not in the warmer, drier months when water is in higher demand;
- **Agriculture:** Climate change could cause a shift in the type and location of agriculture in the area. As saltwater intrudes into coastal aquifers and groundwater resources decrease, it is possible that some crops will be forced out of the area, which affects the

⁶ California Natural Resources Agency. 2009 California Climate Adaptation Strategy Discussion Draft. August 2009.

⁷ U.S. Environmental Protection Agency, Climate Change website. <http://www.epa.gov/climatechange/>, accessed August 5, 2009.

⁸ California Climate Change Center. Our Changing Climate: Assessing the Risks to California (2006), www.climatechange.ca.gov

⁹ Governor's Office of Planning and Research (OPR). Proposed CEQA Guideline Amendments for GHG Emissions. April 2009.

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local economy and food supply. Water supplies to agriculture may be 20 to 23% below demand targets between 2020 and 2050;

- Public Health: Climate change could potentially threaten the health of residents of Arroyo Grande. Heat waves may have a major impact on public health, as will decreasing air quality and an increase in mosquito-breeding and mosquito-borne diseases. There is also expected to be an increase in allergenic plant pollen and an increase in the frequency of wildfires.

Although climate change is a global issue, local governments can make a positive impact through cumulative local action. Cities and counties have the ability to reduce GHG emissions through effective land use and transportation planning, wise waste management, and the efficient use of energy. The City can achieve multiple benefits including lower energy bills, improved air quality, economic development, reduced emissions, and better quality of life through:

- Increased energy efficiency in City facilities and vehicle fleet;
- Sustainable purchasing and waste reduction efforts;
- Sustainable land use and transportation planning; and
- Efficient management of water resources.

This Inventory serves as a baseline measurement for implementing and tracking the effectiveness of these efforts.

1.2 CLIMATE CHANGE - LEGISLATIVE BACKGROUND

California continues to be a leader in addressing climate change in the United States and in the world. In June of 2005, Governor Schwarzenegger issued a landmark Executive Order establishing progressive GHG emissions targets for the entire state. Executive Order (EO) S-3-05 establishes the following goals:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels;
- By 2050, reduce GHG emissions to 80% below 1990 levels.

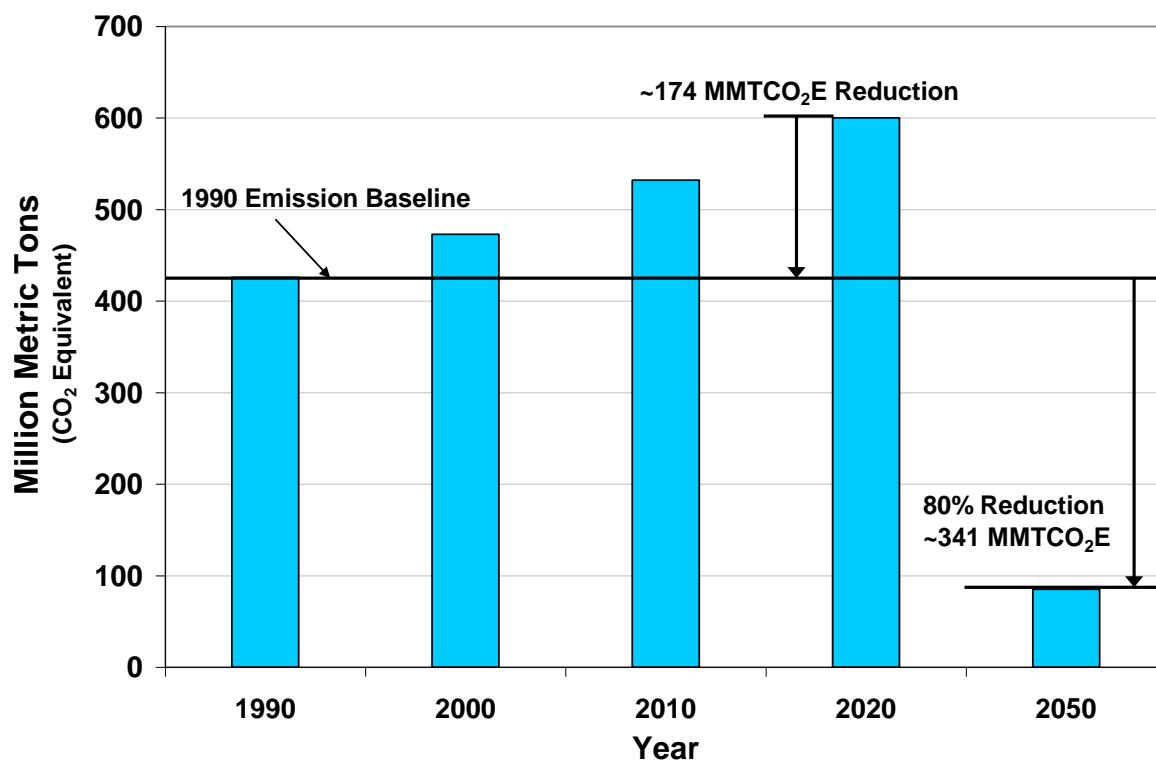
To support these reduction targets, the California legislature adopted the California Global Warming Solutions Act of 2006, also known as Assembly Bill (AB) 32. The law requires the

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California Air Resources Board to develop regulatory and market mechanisms that will reduce GHG emissions to 1990 levels by 2020 as shown in **Figure 1-2** below. To achieve this goal, California Air Resources Board developed a set of early action measures in 2007 for priority implementation in 2010. These early action measures became part of the AB 32 implementation plan, or Scoping Plan, approved in December 2008. The Scoping Plan identifies a variety of GHG reduction activities including direct regulations, monetary and non-monetary incentives, voluntary actions, market-based mechanisms such as a cap-and-trade, and an implementation fee regulation to fund the program. The Scoping Plan also identifies local governments as “essential partners” and calls for cities and counties to adopt GHG reduction targets consistent with AB 32.

**FIGURE 1-2: CALIFORNIA CLIMATE CHANGE
GHG EMISSIONS AND TARGETS**



In support of the AB 32 reduction targets, California adopted Senate Bill (SB) 97 in August 2007 which formally acknowledges that climate change is an important environmental issue that requires analysis under the California Environmental Quality Act (CEQA). In response to SB 97, the Governor's Office of Planning and Research (OPR) submitted their proposed amendments to the CEQA Guidelines for GHG emissions in April 2009. The proposed amendments will

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provide guidance to public agencies regarding the analysis of mitigation and the effects of GHG emissions in CEQA documents. The proposed amendments were certified and adopted in December 2009 and took effect in March 2010.¹⁰

At the same time, the State is working to form regional approaches to reducing GHG emissions in response to the passage of Senate Bill 375 (SB 375). SB 375 aims to reduce GHG emissions by linking transportation funding to land use planning. It also requires Metropolitan Planning Organizations, including the San Luis Obispo Council of Governments, to include a Sustainable Communities Strategy (SCS) in their Regional Transportation Plans (RTPs) for reducing suburban sprawl. The bill also creates incentives for implementation of sustainable communities strategies and sustainable transportation plans. Additional efforts are underway for the overall transportation sector by mandating fewer emissions from vehicles, including Assembly Bill 1493, signed into law in 2002, which requires carmakers to reduce emissions from new passenger cars and light trucks beginning in 2009. The U.S. Environmental Protection Agency (EPA) approved the new emissions standards in June 2009.

The State is also preparing for climate change resiliency in order to adapt to the inevitable effects of climate change. In November 2008, Governor Schwarzenegger signed Executive Order S-13-08 which asked the Natural Resources Agency to identify how state agencies can respond to rising temperature, changing precipitation patterns, sea level rise, and extreme natural events. The order requires the Natural Resources Agency to develop a Climate Adaptation Strategy (CAS) to analyze climate change impacts to the state and recommend strategies to manage those threats. The Natural Resources Agency released a discussion draft of the CAS in August 2009.

1.3 PLANNING PROCESS

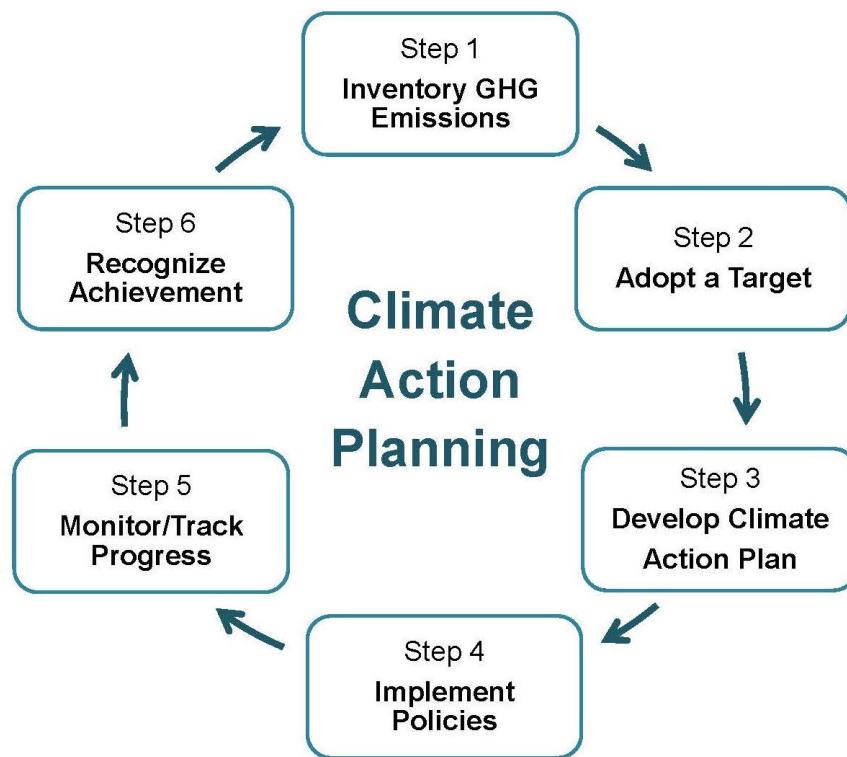
The California Air Resources Board provides a framework for local communities to identify and reduce GHG emissions, organized along six steps as represented in **Figure 1-3** below.¹¹

¹⁰ Governor's Office of Planning and Research (OPR). Proposed CEQA Guideline Amendments for GHG Emissions. April 2009.

¹¹ California Air Resources Board. Local Government Toolkit, <http://www.coolcalifornia.org/local-government>

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FIGURE 1-3: PLANNING PROCESS



This report represents the completion of the first step, and provides a foundation for future work to reduce GHG emissions in the City of Arroyo Grande.

1.4 LOCAL SUSTAINABILITY AND CLIMATE CHANGE MITIGATION ACTIVITIES

Many of the air pollution programs already in place throughout San Luis Obispo County reduce ozone-forming pollutants and toxic emissions, but they also have ancillary benefits and reduce GHG emissions. The County, cities, and the Air Pollution Control District (APCD) implement rules and regulations, clean fuels programs, CEQA mitigation measures, grants, the Transportation Choices Program, pollution prevention activities, energy efficiency and conservation measures, water conservation programs, partnerships, and general public outreach that directly or indirectly address climate change and reduce GHG emissions.

The APCD Board approved the first report or plan to address climate change in the county. The plan, Options for Addressing Climate Change in San Luis Obispo County (2005), identifies the

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following seven actions that could be implemented to specifically address GHGs at the local level:

- 1) Prepare a countywide inventory of GHG emissions;
- 2) Target a percentage of mitigation grant funds for GHG emission reductions;
- 3) Evaluate and quantify the GHG reduction benefits from existing district programs;
- 4) Develop public education and outreach campaigns on climate change;
- 5) Encourage and provide support for local governments to join the Cities for Climate Protection program;
- 6) Develop partnership with Cal Poly for addressing climate change; and
- 7) Join the California Climate Registry and encourage local industry participation.

As of November 2008, the APCD has initiated, promoted, or supported all of the implementation actions to address climate change and reduction of GHG emissions in the County. The APCD joined the California Climate Registry and conducted its GHG emissions inventory in the fall of 2008. The APCD facilitates regular meetings of Climate Change Stakeholders, a local group of city and county representatives that shares resources to address climate change. To encourage and support local GHG emissions inventories, the APCD is providing technical assistance to all of the incorporated cities to assist or perform GHG government operations and community-wide emissions inventories, similar to this Inventory.

The APCD also coordinates the Central Coast Clean Cities Coalition (C5). C5 is a partnership of public/private entities whose goal is to promote the use of alternative fuels vehicles (AFV) on the Central Coast. By working with area fleet operators, C5 sponsors training seminars, public events and grant funding workshops related to use of alternative fuels.

The City of Arroyo Grande has been pursuing energy efficiencies through such measures as:

- Adoption of a Green Corridor tax incentive program (2009)
- Implementation of Water Conservation programs including:
 - ◊ Turf removal financial incentives (2009)
 - ◊ Plumbing Retrofit Program to provide free low-flow toilets and indoor plumbing fixtures (on-going since 2004)

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- ◊ Free irrigation controllers and sensors (on-going since 2009)
- ◊ Mandatory conservation measures (2008)
- ◊ Free Irrigation audits (ongoing since 2009)
- ◊ Sustainable Landscape Seminar Series
- Recycled water study
- Solar and/or wind power facility study
- Public – private project to install compressed natural gas and biodiesel fueling facilities
- Investigating conversion of City fleet to CNG, electric and bio diesel vehicles
- Retrofit of City buildings to increase energy efficiency
- Plan to install solar powered public electric vehicle recharging stations
- Support of SLO Green Build programs
- Police Department vehicles equipped with bicycles and bike racks to supplement patrol with bicycle patrol
- Bicycle and Trails Master Plan (2012)
- Expansion of the park-and-ride lot
- Purchase and installation of bike racks and lockers
- Workplace Bike Sharing Program

1.5 GHG EMISSIONS INVENTORY UPDATE

In 2010, PMC prepared an inventory of Arroyo Grande's 2005 community-wide and City government emissions. Changes to GHG accounting protocols have prompted an update to the emissions inventory and in 2012 Rincon Consultants conducted a peer-review and update to the Inventory. This Inventory is the updated assessment of GHG emissions in Arroyo Grande.

Rincon updated the Inventory methodology, emissions coefficients, and data for consistency with current protocols, including the Local Government Operations Protocol (LGOP) version 1.1

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(May 2010), for the city government inventory, and the Association of Environmental Professionals (AEP) California Community-wide GHG Baseline Inventory Protocol (AEP Protocol) (June 2011) and ICLEI International Local Government GHG Emissions Analysis Protocol (IEAP) (October 2009), for the community-wide inventory. Rincon also updated the Inventory to include all emissions sectors within the discretionary action authority of the City. The primary additions and revisions to the updated Inventory include the following:

- Calculation of emissions from additional off-road vehicle and equipment categories (lawn and garden equipment, construction equipment, industrial equipment, and light commercial equipment) for the community-wide inventory.
- Incorporation of improved emissions factors from the LGOP version 1.1.
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- Corrections to baseline electricity and natural gas consumption data, and waste stream profile data.
- Inclusion of updated population and employment projections using the San Luis Obispo Council of Governments' (SLOCOG) 2040 Population, Housing & Employment Forecast (August 2011).

As a result of the Inventory update, Arroyo Grande's community-wide 2005 baseline emissions decreased by 12,150 metric tons CO₂e and 2020 forecast decreased by 23,043 metric tons CO₂e compared to the April 2010 inventory.

2. Community and Government Operations Inventory

Methodology

The first step toward reducing GHG emissions is to identify baseline levels and sources of emissions in the city. This information can later inform the selection of a reduction target and possible reduction measures to be included in a climate action plan.

This section outlines the methodology used to calculate the community and City government operations¹² inventories, including the difference between the two inventories, and the data collection process, data sources, GHG emission scopes, data limitations, and means of calculation.

2.1 BASELINE AND FORECAST YEARS

The year 2005 was selected as the baseline year for the Inventory due to the availability of reliable data and consistency with other cities in San Luis Obispo County. The State of California uses 1990 as a reference year to remain consistent with the Kyoto Protocol, and also because it has well-kept records of transportation trends and energy consumption in that year. However, cities and counties throughout California typically elect to use 2005 or 2006 as a baseline year because of the more reliable recordkeeping from those years and because of the large amount of growth that has occurred since 1990.

This Inventory uses a forecast year of 2020 to be consistent with the State of California GHG Inventory¹³ forecast year and AB 32 target, both of which reference 2020. In addition, it is likely that any forecast considerably beyond 2020 would have a significant margin of error because of unknown population growth rates and new technology.

2.2 THE TWO INVENTORIES: COMMUNITY-WIDE AND CITY GOVERNMENT OPERATIONS

This Inventory is separated into two sections, community-wide and City government operations. It is important to note that the City government operations inventory is a subset of the community inventory, meaning that all City government operations are included in the commercial/industrial, transportation, waste, or “other” categories of the community-wide

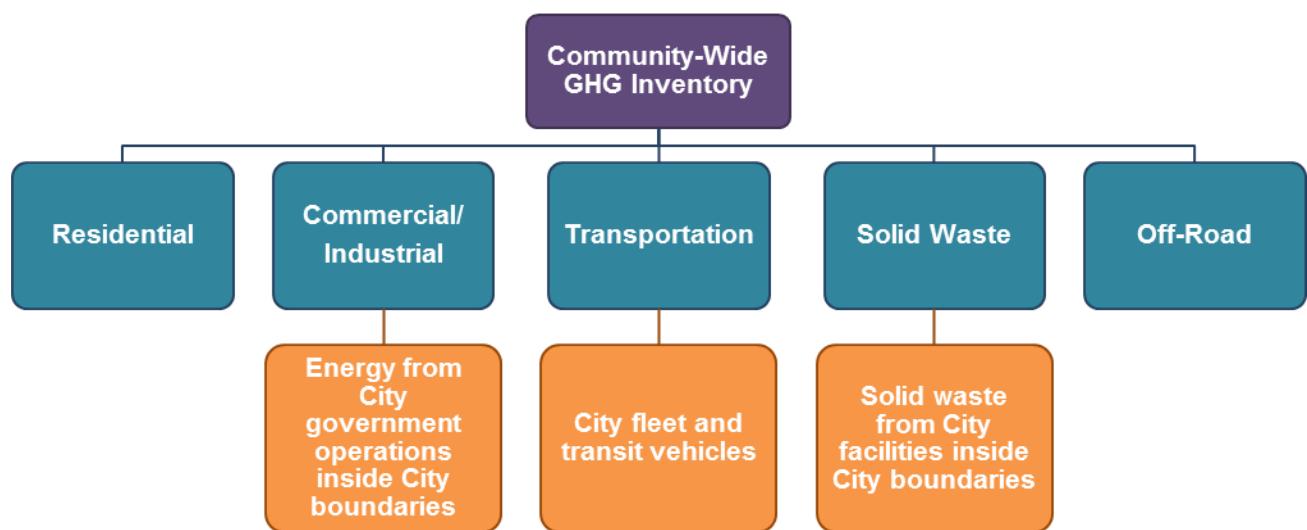
¹² In this report, the term “city” refers to the incorporated area (the jurisdictional boundary of the City of Arroyo Grande), whereas “City” refers to those activities that are under the operational control of City agencies. “Community-wide” or “community” refers to all activities within the city (as defined above), including those from businesses, industrial processes, residents, vehicles, and City government operations.

¹³ California GHG Inventory, <http://www.arb.ca.gov/cc/inventory/inventory.htm>

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inventory. The City's government operations inventory should not be added to the community analysis; rather it should be looked at as a slice of the complete picture as illustrated in **Figure 2-1**. Although City operations are a small contributor to the community's overall emissions levels, an inventory allows the City to track its individual facilities and vehicles and to evaluate the effectiveness of its emissions reduction efforts at a more detailed level.

**FIGURE 2-1: THE RELATIONSHIP BETWEEN
COMMUNITY-WIDE AND CITY GOVERNMENT INVENTORIES**



Once completed, these inventories provide the basis for policy development, the quantification of emissions reductions associated with proposed measures, the creation of an emissions forecast, and the establishment of an informed emissions reduction target.

2.3 DATA COLLECTION AND METHODOLOGY

Creating the community and City government operations emissions inventories required the collection of information from a variety of sources. Sources for community data included the Pacific Gas and Electric Company (PG&E), the Southern California Gas Company, Caltrans, and Cal-Recycle. City government operations data sources included PG&E, the Southern California Gas Company, South County Sanitary District, and documentation from multiple City departments including planning, public works, fleet maintenance, accounts receivable and more. Data from the year 2005 were used in both inventories, with the following exceptions:

- A subset of waste data by type was not available for 2005, therefore this study utilizes a California statewide waste characterization study conducted in 2003-2004;

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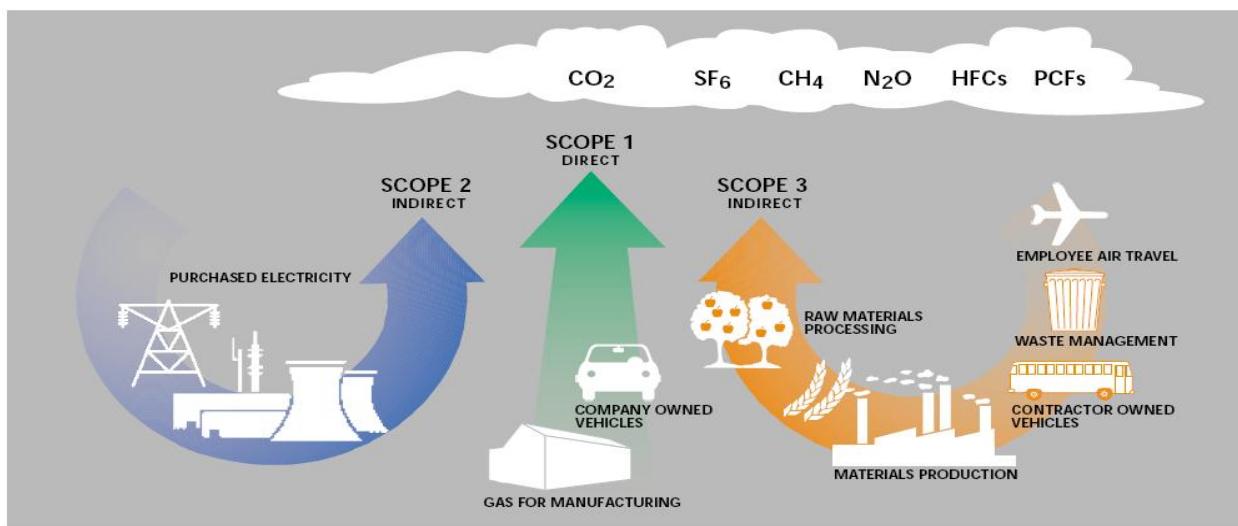
- City employee commuting trips were calculated using an employee survey conducted in 2009;
- Complete City vehicle fleet data was not available for 2005, therefore this study utilized 2007, the first full calendar year for which data was available; and
- Propane, wind and solar power used in the community.

For community activities and City operations, emissions sources are categorized by scope. Scopes help us identify where emissions originate from and what entity retains regulatory control and the ability to implement efficiency measures. The scopes are illustrated in **Figure 2-2** and defined as follows:

- **Scope 1.** Direct emissions sources located within the community, mostly from the combustion of fuels. Examples of Scope 1 sources include use of fuels such as gasoline and natural gas.
- **Scope 2.** Indirect emissions that result because of activities within the community, limited to electricity, district heating, steam and cooling consumption. An example of a Scope 2 source is purchased electricity used within the community. These emissions should be included in the community-wide analysis, as they are the result of the community's electricity consumption.
- **Scope 3.** All other indirect emissions that occur as a result of activity within the community. Examples of Scope 3 emissions include methane emissions from solid waste generated within the community which decomposes at landfills either inside or outside of the community.

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FIGURE 2-2: GHG EMISSIONS SCOPES



Source: NZBCSD (2002), The Challenge of GHG Emissions: the “why” and “how” of accounting and reporting for GHG emissions: An Industry Guide, New Zealand Business Council for Sustainable Development, Auckland

Appendices A and B of this report separate the community and City government operations emissions by scope. Each sector is labeled with a 1, 2, or 3 that corresponds to the scopes above.

2.4 DATA SOURCES

The data used to complete this Inventory came from multiple sources, as summarized in **Tables 2-1 and 2-2**. Utility providers supplied electricity and natural gas consumption data associated with commercial, industrial, residential, and City government buildings in 2005. Fehr and Peers provided VMT information, which was calculated using SLOCOG's Regional Travel Demand model. These data sources are further explained in the sector-specific discussions of this document.

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TABLE 2-1: DATA SOURCES FOR COMMUNITY ANALYSIS, 2005

Sector	Information	Unit of Measurement	Data Source
Residential	Electricity consumption	kWh	PG&E
	Natural gas consumption	Therms	Southern California Gas Company
Commercial/Industrial	Electricity Consumption	kWh	PG&E
	Natural gas consumption	Therms	Southern California Gas
Transportation	VMT excluding pass through trips	Average Weekday Daily VMT	Fehr & Peers
Off-Road Vehicles and Equipment	Emissions from off-road equipment	Tons/year of N ₂ O, CO ₂ , and CH ₄	California Air Resources Board OFFROAD2007
Solid Waste	Solid waste tonnage sent to landfill from activities in Arroyo Grande	Short tons	San Luis Obispo Integrated Waste Management Board

TABLE 2-2: DATA SOURCES FOR CITY GOVERNMENT ANALYSIS, 2005

Sector	Information	Unit of Measurement	Data Source
Buildings & Facilities	Electricity consumption	kWh	PG&E
	Natural Gas consumption	Therms	Southern California Gas Company
Vehicle Fleet	Diesel consumption and vehicle type	Gallons	Vehicle Fleet Report Fuel Use Report
	Gasoline consumption and vehicle type	Gallons	Vehicle Fleet Report Fuel Use Report
Employee Commute	Sample of employee commuting patterns	Annual VMT	Commuter Survey (September 2009)
Streetlights	Electricity consumption	kWh	PG&E
Water/Sewage	Electricity consumption	kWh	Billing Records
Waste	Annual waste tonnage sent to landfill	Tons	South County Sanitary District
Other - Misc. equipment	Fuel consumption by equipment type	Gallons	Billing Records

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2.5 DATA LIMITATIONS

It is important to note that calculating community-wide GHG emissions with precision is a complicated task. The ICLEI Clean Air and Climate Protection (CACP2009) software relies on numerous assumptions and is limited by the quantity and quality of available data. Because of these limitations it is useful to think of any specific number generated by the model as an approximation of reality, rather than an exact value. The City's actual 2005 GHG emissions are likely to be *slightly* greater than what are reported in this document due to three main factors: (1) data limitations, (2) privacy laws, and 3) a lack of a reasonable methodology to collect or model emissions data. The following paragraphs highlight emissions that cannot be included in a GHG Inventory under current science and policy direction or due to lack of reliable data.

Data Limitations

Lack of available data prevented the calculation of emissions from community-wide propane use and City government operations refrigerants. Lack of data availability also prevents the calculation of emissions from propane (liquefied petroleum gas, or LPG) created within the city's boundaries. Propane is basically an unregulated fuel in California (except for storage and safety issues which are regulated). Because it is an unregulated commodity, no data is collected by the state on propane sales or usage. Another sector that was excluded from the inventory is City government operations refrigerants.

The City of Arroyo Grande made a best effort to gather data on the amount of refrigerants consumed by fleet vehicles, HVAC systems, and City government operations facilities; however City records were not suited to this purpose. **It is recommended that the City look into amending its record keeping so that the amount of refrigerants purchased and consumed within a year is recorded.**

Privacy Laws

This Inventory does not separately analyze site-level emissions from specific sources such as refineries or large industrial emitters. The emissions from industrial energy consumption and related transportation are included under the commercial/industrial category, but will not be analyzed independently as part of this Inventory for two reasons:

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- 1) State privacy laws prevent us from obtaining site-level energy consumption data from utility providers. Notably the California Public Utilities Commission 15/15 rule¹⁴ prevents us from analyzing industrial emissions separately from commercial emissions.
- 2) It is the responsibility of the emitter, whether it is a large refinery or household, to perform its energy audit and subsequent reduction process. Efforts to require site-level energy audits and GHG emissions reporting are being continually expanded and required by the California Climate Action Registry, U.S. EPA, and California Air Resources Board.

The City of Arroyo Grande has little to no industrial uses. As such, the inclusion of these emissions under a combined commercial/industrial category does not represent a significant limitation for analysis.

Lack of a reasonable methodology

As stated in GHG inventorying protocols, a lack of a reasonable methodology for calculating carbon dioxide, methane, and nitrous oxide prevents estimation of lifecycle emissions for the community. Lifecycle emissions are emissions associated with the production and disposal of items consumed by a community. For instance, a lifecycle assessment would estimate the emissions associated with the planning, production, delivery, and disposal of each car currently in the city. In contrast, this analysis only captures how much that car drives within the city.

Despite these limitations, the CACP2009 software¹⁵ and ICLEI methodology provide the best-available snapshot of the city's GHG emissions. Additionally, the CACP2009 tool is utilized to promote consistency among municipalities throughout the country and the world. Sector-specific data limitations or methodological issues are explained thoroughly in **Appendices C and D**.

However, it is important to note that the emissions identified in this report are primarily GHGs that the community has directly caused and has the ability to reduce through implementation of conservation actions, a Climate Action Plan, or corresponding efforts.

¹⁴ Commercial and Industrial Electricity and Natural Gas were combined into one section due to the California 15/15 rule. The 15/15 rule was adopted by the California Public Utilities Commission in the Direct Access Proceeding (CPUC Decision 97-10-031) to protect customer confidentiality.

¹⁵ The Clean Air and Climate Protection (CACP2009) software 2009 was developed by the State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (SAPPA/ALAPCO), the International Council for Local Environmental Issues (ICLEI), and Torrie Smith Associates.

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2.6 CLEAN AIR AND CLIMATE PROTECTION SOFTWARE 2009

The City government operations and community-wide inventories use the CACP2009 software package developed by ICLEI in partnership with the National Association of Clean Air Agencies and Torrie Smith Associates. This software calculates emissions resulting from energy consumption, VMT, and waste generation. The CACP2009 software calculates emissions using specific factors (or coefficients) according to the type of fuel used.

CACP2009 aggregates and reports the three main GHG emissions (CO₂, CH₄, and N₂O) and converts them to equivalent carbon dioxide units, or CO₂e. Equalizing the three main GHG emissions as CO₂e allows for the consideration of different GHGs in comparable terms. For example, methane (CH₄) is 21 times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat, so the CACP2009 software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents.¹⁶

The emissions coefficients and quantification method employed by the CACP2009 software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary GHG Reporting Guidelines (EIA form 1605).

¹⁶ The potency of a given gas in heating the atmosphere is defined as its Global Warming Potential, or GWP. For more information on GWP see: IPCC Fourth Assessment Report, Working Group I, Chapter 2, Section 2.10.

3. Community GHG Inventory Results

The City of Arroyo Grande contains primarily residential and commercial land uses. In the 2005 baseline year, there were approximately 16,330 people, 7,940 jobs, and 7,227 households in the City.¹⁷ The following section provides an overview of the emissions caused by activities within the jurisdictional boundary of the city and analyzes the emissions in terms of scope, sector, source, and population.

3.1 COMMUNITY-WIDE EMISSIONS BY SCOPE

Although there are countless items that can be included in a community-wide emissions inventory, as discussed in Chapter 2, this Inventory includes Scope 1, Scope 2, and Scope 3 sources from the following sectors, consistent with the ICLEI protocol:

- Residential
- Commercial / Industrial
- Transportation
- Waste
- Off-Road Vehicles and Equipment

What are Scopes?

The key principles to remember are that Scope 1 emissions are caused by activities within the city and emitted within the city (fuel combustion), while Scope 2 emissions are caused by activities within the city, but most likely are emitted outside of the city (electricity). Scope 3 emissions are indirect emissions, such as waste decomposition.

Table 3-1 summarizes the scopes of each sector in this analysis.

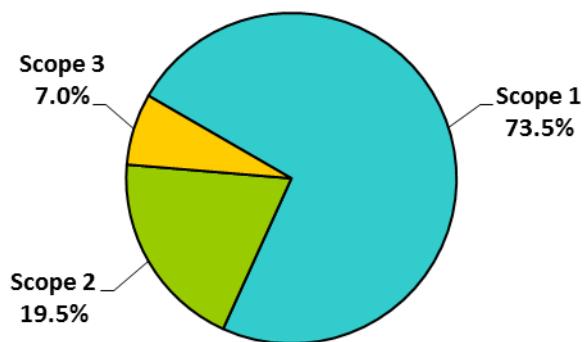
¹⁷ Baseline population, housing, and job data for the year 2005 was obtained from SLOCOG's Long Range Socio-Economic Projections (Year 2030), prepared by Economics Research Associates (July 2006 Revision).

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

**TABLE 3-1: EMISSION SOURCES INCLUDED IN COMMUNITY
INVENTORY BY SCOPE AND SECTOR, 2005**

Sector	Scope 1	Scope 2	Scope 3
Residential	Natural Gas	Electricity	---
Commercial/Industrial	Natural Gas	Electricity	---
Transportation	Gasoline & Diesel	---	---
Off-Road Vehicles and Equipment	Gasoline, Diesel & Compressed Natural Gas	---	---
Waste	---	---	Methane from Decomposition

**FIGURE 3-1: COMMUNITY GHG
EMISSIONS BY SCOPE, 2005**



Including all sectors and scopes, the community emitted approximately 84,399 metric tons of CO₂e in 2005. As shown in **Figure 3-1** and **Table 3-2**, the majority of community GHG emissions were Scope 1 (73.5%), with Scope 2 (19.5%) and Scope 3 (7.0%) constituting the remainder.

The largest portion of Scope 1 emissions came from the transportation sector (refer to **Table 3-2** and **Figure 3-1**). These emissions qualify as Scope 1 because they involve the direct combustion of fuel within the jurisdictional boundary of the city. The second largest source of Scope 1 emissions was residential natural gas use. Residential

uses also generated the largest percentage of Scope 2 emissions. Emissions from waste operations account for the whole of Scope 3 emissions.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

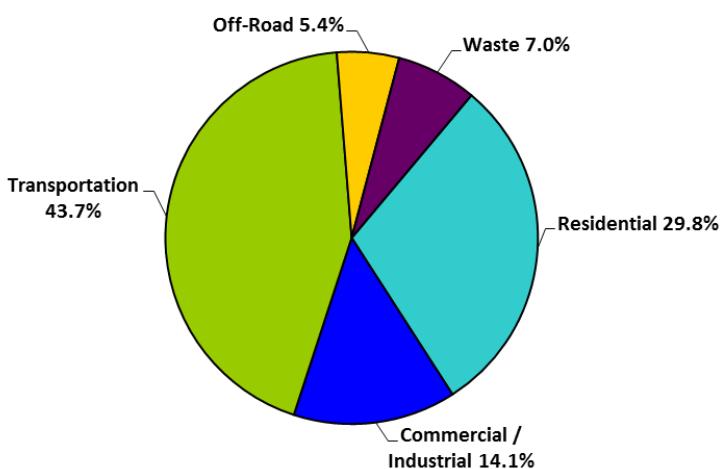
**TABLE 3-2: COMMUNITY GHG EMISSIONS PER SECTOR PER SCOPE,
2005 (METRIC TONS OF CO₂E)**

Sector	Scope 1	Scope 2	Scope 3	Total
Residential	16,358	8,747	---	25,105
Commercial/Industrial	4,186	7,746	---	11,932
Transportation	36,897	---	---	36,897
Off-Road Vehicles and Equipment	4,556	---	---	4,556
Waste	---	---	5,909	5,909
TOTAL	61,997	16,493	5,909	84,399
Percentage of Total CO ₂ e	73.5%	19.5%	7.0%	100.0%

3.2 ALL SCOPE EMISSIONS BY SECTOR

As noted above, the community emitted approximately 84,399 metric tons of CO₂e in calendar year 2005. In addition to analyzing the data by scope, it can also be aggregated by sector. As depicted in **Figure 3-2** and **Table 3-3** below, the transportation sector was the largest emitter (43.7%) in 2005. Emissions from the residential sector were the next largest contributor (29.8%), while the commercial and industrial sectors accounted for a combined 14.1% of the total. Emissions from solid waste comprised 7.0% of the total, and emissions from other sources such as agricultural equipment comprised 5.4% of the total.

FIGURE 3-2: COMMUNITY GHG EMISSIONS BY SECTOR, 2005



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TABLE 3-3: COMMUNITY GHG EMISSIONS BY SECTOR, 2005

2005 Community Emissions by Sector	Residential	Commercial/ Industrial	Transportation	Off- Road	Solid Waste	TOTAL
CO ₂ e (metric tons)	25,105	11,932	36,897	4,556	5,909	84,399
Percentage of Total CO ₂ e	29.8%	14.1%	43.7%	5.4%	7.0%	100%

3.3 TRANSPORTATION

Transportation sector emissions are the result of diesel and gasoline fuel used in vehicles traveling on local roads and state highways within the jurisdictional boundaries of Arroyo Grande. Consistent with the majority of California communities, travel by on-road motorized vehicles constitutes the greatest percentage of GHG emissions in the city (43.7%). Of the total transportation sector emissions, an estimated 93.2% was due to gasoline consumption, with the remaining 6.8% was due to diesel fuel use (refer to Figure 3-3 and Table 3-4).

**FIGURE 3-3: TRANSPORTATION
EMISSIONS BY FUEL TYPE**

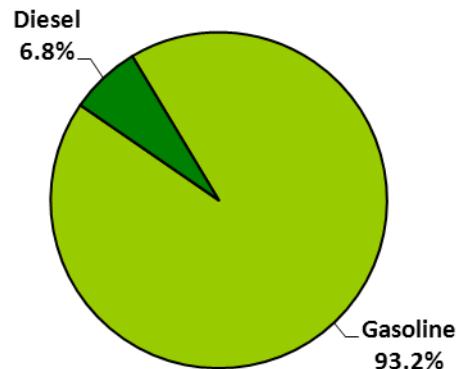


TABLE 3-4: TRANSPORTATION GHG EMISSIONS BY FUEL SOURCE

2005 Transportation Fuel Emissions Sources	Gasoline	Diesel	TOTAL
CO ₂ e (metric tons)	34,395	2,502	36,897
Percentage of Total CO ₂ e	93.2%	6.8%	100%

Using origin-destination analysis and the SLOCOG Regional Travel Demand Model, three types of vehicle trips were tracked in the city:

1. Internal-Internal: Vehicle trips that remained inside the city

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2. Internal-External and External-Internal: Vehicle trips that have an ending or a beginning in the city
3. External-External: Vehicle trips that pass through the city without originating or ending in the city

Fehr & Peers calculated VMT for each of the three types of vehicle trips using the recommendation of the Regional Target Advisory Committee (RTAC), the body responsible for Senate Bill 375 target setting. VMT from trips of type 1, 2, and 3 (see above) were counted 100%, 50%, and 0% respectively toward jurisdiction-generated VMT.¹⁸ The VMT results are summarized in **Appendix A**. Annual VMT was then analyzed to determine GHG emissions from vehicle travel using the EMFAC2011 software developed by the California Air Resources Board. EMFAC2011 uses emissions rates for different types of vehicles in conjunction with travel activity statistics to calculate vehicle based emissions in metric tons per day. For a detailed description of the methodology used to estimate transportation-related emissions, please see **Appendix C**.

3.4 OFF-ROAD VEHICLES AND EQUIPMENT

Gasoline, diesel, and compressed natural gas fuel are used to power off-road equipment in the City of Arroyo Grande. Off-road equipment incorporated in this inventory includes agriculture, lawn and garden, construction vehicles and equipment, light commercial equipment, and industrial equipment. Off-road vehicles and equipment accounted for 5.4% of the City's emissions in 2005. The California Air Resources Board's OFFROAD 2007 software provides emissions data for off-road equipment by county. The countywide data was attributed to city based on the indicators presented in **Table 3-5**.

TABLE 3-5: COUNTY-WIDE EQUIPMENT TYPE INDICATORS

Equipment Type	Allocation Indicator
Agricultural Equipment	Acres of cropland
Construction Vehicles and Equipment	Construction jobs
Industrial Equipment	Industrial jobs
Lawn and Garden Equipment	Households
Light Commercial Equipment	Service and commercial jobs

¹⁸ Since external-external VMT is the result of vehicle trips that pass through the city without originating or ending in the city, they are excluded from the inventory as the City is unable to directly impact these VMT. However, they are identified in Appendix A for informational purposes only.

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Approximately 73.1% of off-road equipment emissions in 2005 came from construction vehicles and equipment, while 13.4% were the result of light and commercial equipment. The remaining off-road equipment activities included in this Inventory include lawn and garden equipment, agricultural equipment, and industrial equipment, making up the remaining 13.5% of emissions collectively (see **Figure 3-4** and **Table 3-6**). Total emissions from off-road equipment for 2005 are estimated to be approximately 4,556 MT CO₂e. Of the total emissions in the off-road sector, an estimated 84.1% was due to diesel consumption, with the remaining 15.9% coming from gasoline and compressed natural gas use (see **Figure 3-5** and **Table 3-7**).

FIGURE 3-4: OFF-ROAD GHG EMISSIONS BY EQUIPMENT TYPE

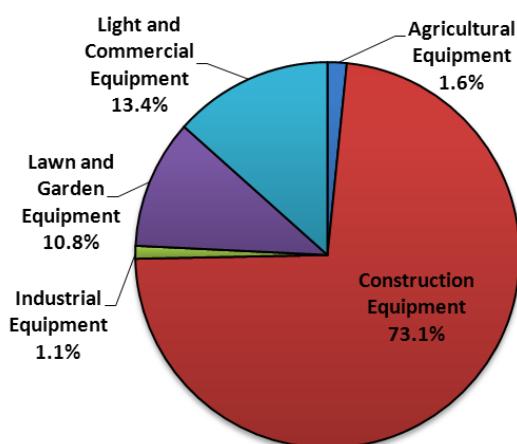


FIGURE 3-5: OFF-ROAD GHG EMISSIONS BY FUEL TYPE

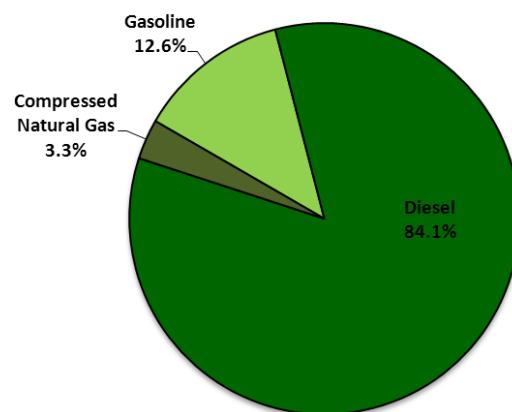
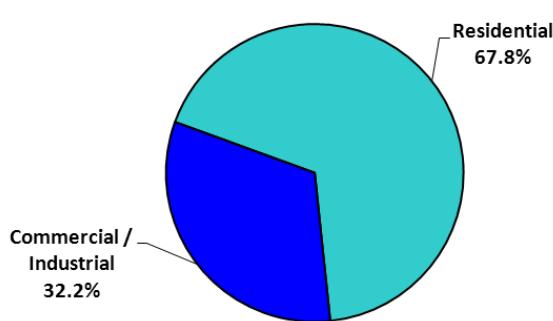


TABLE 3-6: OFF-ROAD GHG EMISSIONS BY EQUIPMENT TYPE

2005 Equipment Emissions Sources	Agricultural Equipment	Construction Equipment	Industrial Equipment	Lawn and Garden Equipment	Light and Commercial Equipment	TOTAL
CO ₂ e (metric tons)	73	3,330	49	493	611	4,556
Percentage of Total CO ₂ e	1.6%	73.1%	1.1%	10.8%	13.4%	100%

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**FIGURE 3-6: BUILT ENVIRONMENT
GHG EMISSIONS BY SECTOR**



**FIGURE 3-7: BUILT ENVIRONMENT
GHG EMISSIONS BY SOURCE**

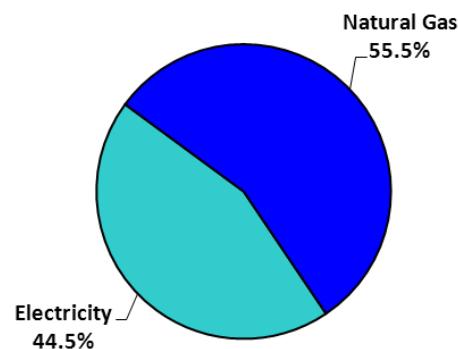


TABLE 3-7: OFF-ROAD GHG EMISSIONS BY FUEL TYPE

2005 Off-Road Fuel Emissions Sources	Gasoline	Diesel	Compressed Natural Gas	TOTAL
CO ₂ e (metric tons)	575	3,830	151	4,556
Percentage of Total CO ₂ e	12.6%	84.1%	3.3%	100%

3.5 THE BUILT ENVIRONMENT (RESIDENTIAL AND COMMERCIAL/INDUSTRIAL)

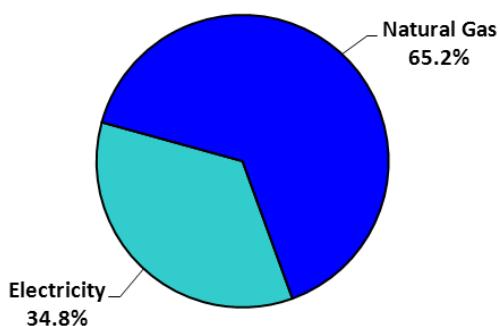
With all scopes aggregated, 43.9% of total community-wide emissions in the year 2005 came from the “built environment.” The built environment comprises residential, commercial, and industrial natural gas and electricity consumption. This analysis does not include emissions from other types of energy such as propane, solar, and wind due to lack of reliable data. The commercial and industrial sectors are combined in this Inventory due to the mandatory aggregating of commercial and industrial data by PG&E previously referenced.

In 2005, 67.8% of emissions from the built environment were from the residential sector, with the remaining 32.2% resulting from the commercial/industrial sectors (see **Figure 3-6**). All of the emissions calculated from the built environment were the result of local natural gas consumption (Scope 1) and local consumption of electricity generated outside of the city (Scope 2). Overall, natural gas consumption caused the majority of emissions from the built environment in 2005, as shown in **Figure 3-7**.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

Approximately 65.2% of emissions in the residential sector resulted from combustion of natural gas for heating and cooking (see **Figure 3-8** and **Table 3-8**), while 35.1% of emissions in the commercial/industrial sector came from natural gas usage (see **Figure 3-9** and **Table 3-9**).

**FIGURE 3-8: RESIDENTIAL
GHG EMISSIONS BY
SOURCE**



**FIGURE 3-9: COMMERCIAL/
INDUSTRIAL GHG EMISSIONS BY
SOURCE**

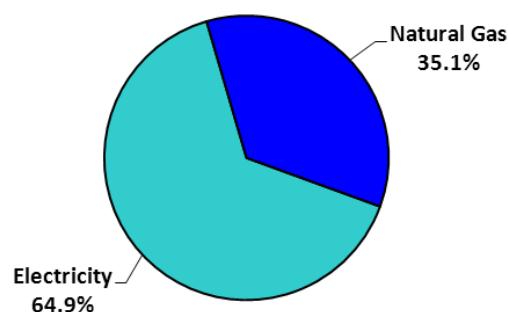


TABLE 3-8: RESIDENTIAL GHG EMISSIONS BY SOURCE

Residential Emissions Sources 2005	Electricity	Natural Gas	TOTAL
CO ₂ e (metric tons)	8,747	16,358	25,105
Percentage of Total CO ₂ e	34.8%	65.2%	100%
Energy Use (MMBtu)	133,487	307,505	440,992

TABLE 3-9: COMMERCIAL/INDUSTRIAL GHG EMISSIONS BY SOURCE

Commercial/Industrial Emissions Sources 2005	Electricity	Natural Gas	TOTAL
CO ₂ e (metric tons)	7,746	4,186	11,932
Percentage of Total CO ₂ e	64.9%	35.1%	100%
Energy Use (MMBtu)	118,213	78,682	196,895

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3.6 WASTE

Solid waste disposed of at managed landfills was responsible for 7.0% of total emissions for the community. The CACP2009 software calculates methane generation from waste sent to landfills in 2005 and accounts for the reported methane recovery factors among the two utilized landfills (Cold Canyon and Chicago Grade), which each had a methane capture rate of 60% in 2005. Cold Canyon Landfill accepted approximately 98% of the community's solid waste, while approximately 2% went to Chicago Grade. The methane recovery factors of the landfills are well documented by the San Luis Obispo County Air Pollution Control District based on the system operations at that time. For more information, please see detailed methodology in **Appendix C**.

Waste emissions are considered Scope 3 emissions because they are not generated in the base year, but will result from the decomposition of waste generated in 2005 over the full 100-year+ cycle of its decomposition. In 2005, the community sent approximately 20,245 tons of waste to landfills, including recycled materials used for cover. The 2004 California Statewide Waste Characterization Study provides standard waste composition for the State of California.¹⁹ Identifying the different types of waste in the general mix is necessary because during decomposition various materials generate methane within the anaerobic environment of landfills at differing rates. Carbonaceous materials such as paper and wood would actually sequester²⁰ the methane released in managed landfills, thereby offsetting some or all of the emissions from food and plant waste. However, GHG sequestration at the landfills has been set to zero, based on guidance in the LGOP version 1.1, which recommends eliminating the effect of landfill sequestration for both government operations inventories and community inventories, to be consistent with the principle that local government operations and community inventories should not account for emissions sinks. **Figure 3-10** and **Table 3-10** show the estimated percentage of emissions coming from the various types of organic, methanogenic waste.

¹⁹ <http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097>

²⁰ Sequestration involves the storage of carbon dioxide in a solid material through biological or physical processes.

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FIGURE 3-10: WASTE GHG EMISSIONS BY TYPE, 2005

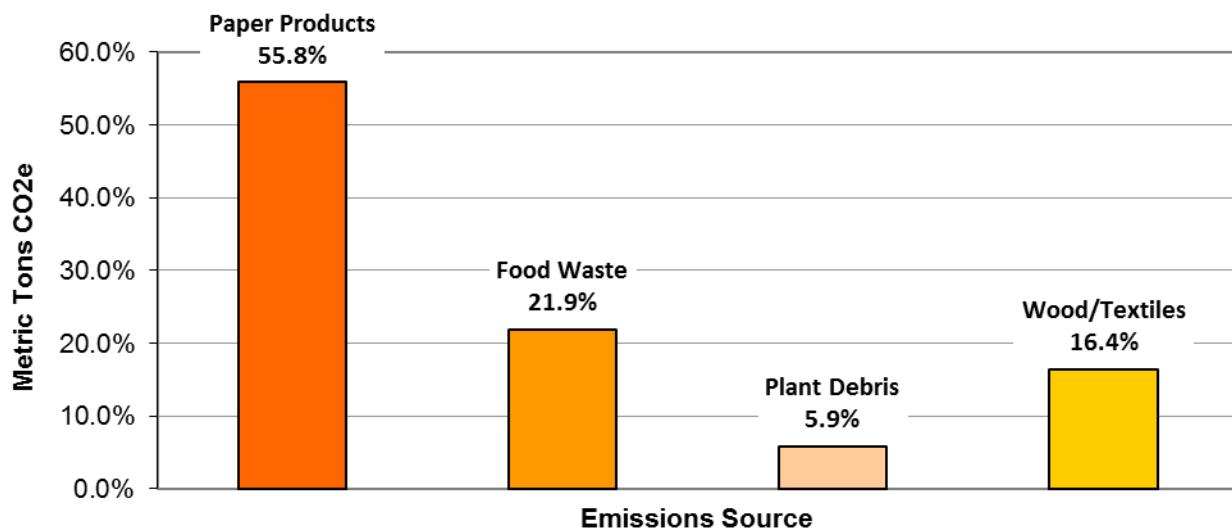


TABLE 3-10: WASTE GHG EMISSIONS BY WASTE TYPE

Waste Emissions Sources 2005	Paper Products	Food Waste	Plant Debris	Wood / Textiles	All Other Waste	TOTAL
CO ₂ e (metric tons)	3,299	1,294	347	969	0	5,909
Percentage of Total CO ₂ e	55.8%	21.9%	5.9%	16.4%	0.0%	100%

3.7 COMMUNITY EMISSIONS BY SOURCE

In addition to viewing emissions by sector and by scope, policy and program development can benefit from an analysis of emissions according to their raw fuel or waste source. **Figure 3-11** and **Table 3-11** below demonstrate that 41.4% of all community emissions come from the consumption of gasoline on local roads and highways. Natural gas (24.5%) and electricity (19.6%) consumption are the next most significant figures, with the remainder coming from diesel fuel and various waste products.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

FIGURE 3-11: COMMUNITY GHG EMISSIONS BY SOURCE, 2005

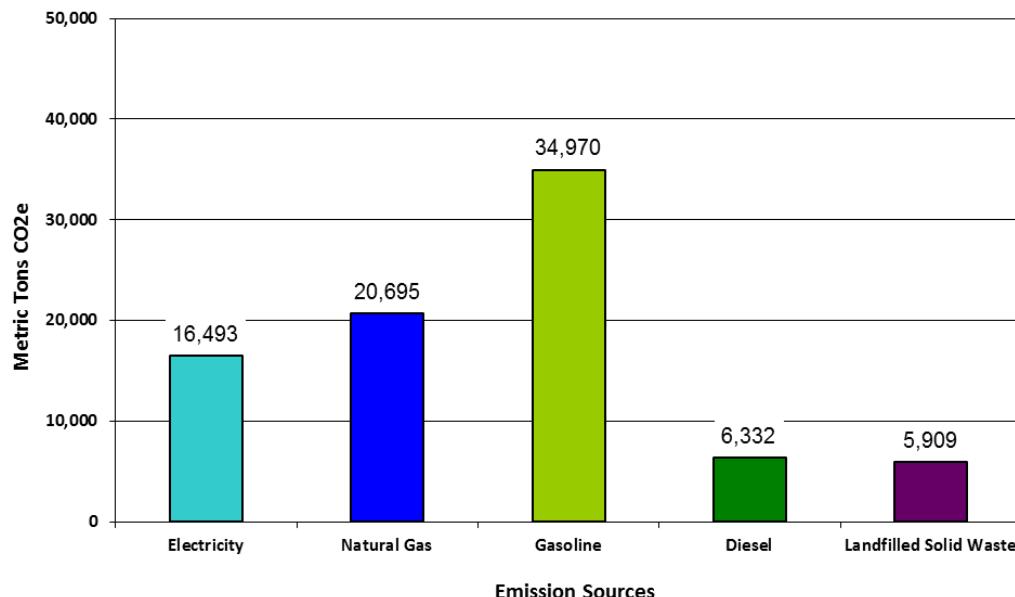


TABLE 3-11: COMMUNITY GHG EMISSIONS BY SOURCE, 2005

Community Emissions 2005 by Source	CO ₂ e (metric tons)	CO ₂ e (percent of total)
Electricity	16,493	19.6%
Natural Gas	20,695	24.5%
Gasoline	34,970	41.4%
Diesel	6,332	7.5%
Landfilled Solid Waste	5,909	7.0%
TOTAL	84,399	100.0%

3.8 PER CAPITA EMISSIONS

Per capita emissions can be a useful metric for measuring progress in reducing GHGs and for comparing one community's emissions with neighboring cities and against regional and national averages. Currently it is difficult to make meaningful comparisons between local inventories because of variations in the scope of inventories conducted. For instance, this Inventory takes into account emissions from off-road vehicles, which some inventories do not. Only when ICLEI,

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

the California Air Resources Board, and other organizations adopt universal reporting standards will local inventories be prepared in a consistent manner and therefore be comparable.

Simply dividing total community GHG emissions by city population in 2005 (16,330) yields a result of 5.17 metric tons CO₂e per capita.²¹ It is important to understand that this number is not the same as the carbon footprint of the average individual living in the City of Arroyo Grande, which reflects a wider scope of emissions, and that the per capita emissions number for the city is not directly comparable to every per capita number produced by other emissions studies because of differences in emissions inventory methods.

²¹ Baseline population data for the year 2005 was obtained from SLOCOG's Long Range Socio-Economic Projections (Year 2030), prepared by Economics Research Associates (July 2006 Revision).

4. City Government Operations GHG Emissions Inventory Results

In 2005, the City of Arroyo Grande government employed 105 people and was comprised of nine departments: Administrative Services, Building and Fire, City Managers offices, Community Development, Legislative and Information Services/City Clerk, Parks, Recreation and Facilities, Police, and Public Works.²² This chapter identifies the results of the City government operations inventory by GHG emissions sector and source.

4.1 CITY GOVERNMENT OPERATIONS INVENTORY RESULTS

City government operations and facilities produced approximately 1,227 metric tons of GHG emissions in 2005. As displayed in **Figure 4-1**, this represents approximately 1.5% of total community-wide emissions. City government emissions result from waste, energy consumption from water and wastewater facilities, buildings, streetlights and other facilities, fuel consumption by the vehicle fleet and employee commutes, and miscellaneous equipment. The vehicle fleet was the largest contributor to the City's emissions (28.0%) with 344 metric tons of carbon dioxide equivalent. The second largest contributor (20.8%) was from the employee commute. (Refer to **Figure 4-2** and **Table 4-1** below.)

FIGURE 4-1: CITY GOVERNMENT CONTRIBUTION TO COMMUNITY-WIDE GHG EMISSIONS

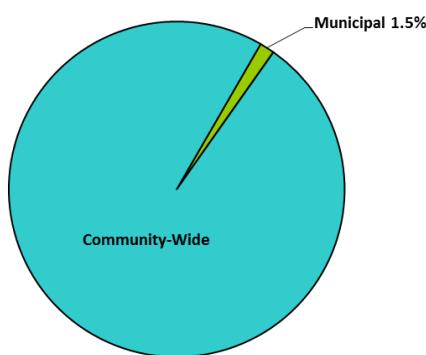
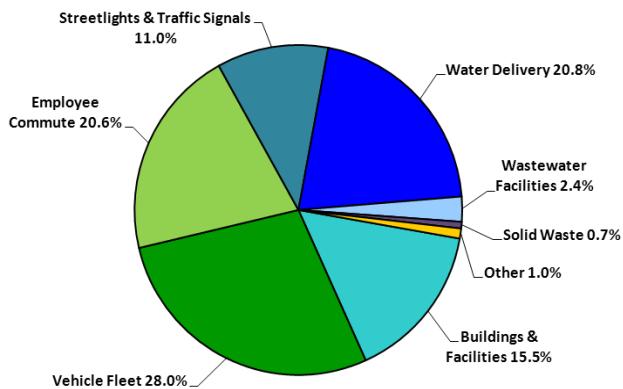


FIGURE 4-2: CITY GOVERNMENT GHG EMISSIONS BY SECTOR, 2005



²² Please note that the City reorganized in 2009 and the number and names of departments changed.

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As mentioned in the Introduction, these emissions are a subset of the community emissions inventory discussed in Chapter 3. The City's government operations emissions are separately analyzed in this section in a manner that is similar to the way in which industry or business would produce a facility-scale GHG audit. The LGOP version 1.1 developed by the California Air Resources Board, The Climate Registry, the California Climate Action Registry, and ICLEI guides the methodology for estimating emissions from local government operations.

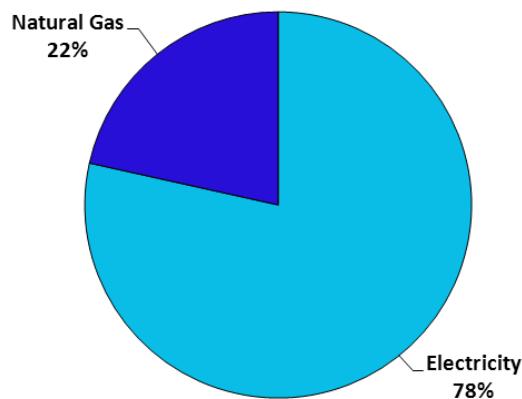
TABLE 4-1: CITY GOVERNMENT GHG EMISSIONS BY SECTOR, 2005

2005 Emissions by Sector	Buildings & Facilities	Vehicle Fleet	Employee Commute	Streetlights & Traffic Signals	Water Delivery	Waste-water Facilities	Solid Waste	Other	TOTAL
CO ₂ e (metric tons)	190	344	253	135	255	30	8	12	1,227
Percentage of CO ₂ e	15.5%	28.0%	20.6%	11.0%	20.8%	2.4%	0.7%	1.0%	100.0%
Energy Use (MMBtu)	3,095	4,933	3,596	2,062	3,891	461	n/a	n/a	18,038

4.2 BUILDING SECTOR

The building sector includes GHG emissions from energy consumption in facilities owned and operated by a municipality. This inventory calculates electricity and natural gas consumption in City-owned and -operated facilities. The facilities included in this analysis include City Hall, Police and Fire stations, Public Works Yard, the Community and Recreation Centers, sports facilities, parks, and numerous other facilities. Streetlights and traffic signals, and facilities associated with the conveyance of water are analyzed separately. As depicted in **Figure 4-3** and **Table 4-2**, the majority of emissions resulted from electricity consumption (78%).

FIGURE 4-3: BUILDING GHG EMISSIONS BY SOURCE



GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

TABLE 4-2: BUILDING SECTOR GHG EMISSIONS BY SOURCE, 2005

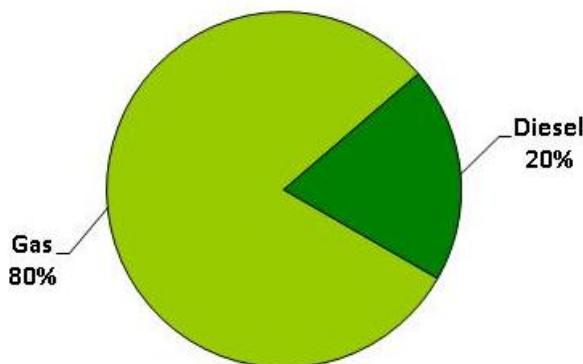
2005 City Government Building Emissions by Source	Electricity	Natural Gas	Total
CO ₂ e (metric tons)	137	53	190
Percentage of Total CO ₂ e	72.1%	27.9%	100.0%
Energy Use (MMBtu)	2,097	998	3,095

These emissions and associated consumption data will be useful in designating priority facilities for energy efficiency retrofits and conservation outreach.

4.3 VEHICLE AND TRANSIT FLEET

City-owned and -operated vehicles emitted approximately 344 metric tons of CO₂e, or 28.0% of total City government emissions. This sector includes gasoline and diesel consumption from all departments in the City operating vehicles, including the Fire and Police departments, Parks and Recreation, and Community Development. This estimate is based on 2007 data, the earliest calendar year for which complete data is available. No significant changes in the vehicle fleet or operating practices occurred during this time interval.

FIGURE 4-4: VEHICLE FLEET FUEL CONSUMPTION PER YEAR BY TYPE



The majority of fuel used by the City is gasoline (80.3%), with the rest diesel (19.7%) (see **Figure 4-4**). When compared to the total emissions per fuel type, diesel emissions actually produce less CO₂e for the vehicle types used by the City. However, there are other, non-CO₂e emissions from diesel-like particulate matter that make such a comparison misleading to the reader. The trend for diesel to emit less CO₂e in this case does not necessarily mean that the City should aim to convert more vehicles to conventional diesel. There are multiple clean and alternative fuel options available,

including biodiesel conversion, electric vehicles, hybrid vehicles, smaller vehicles, and shared vehicles.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

4.4 EMPLOYEE COMMUTE

This sector estimates GHG emissions from City employees traveling to and from work in 2005. The estimate is based on a June 2009 online survey conducted by the City, a blank version of which is included as **Appendix F**. Approximately 55 employees responded to the survey with usable information, meaning that all essential questions were answered, for an approximate a 62% response rate, the results of which were applied to the City employment total for 2005.

The online survey found that most City employees travel to and from work by car. Employees were asked how many days of the week they travel by each commute mode, including driving alone (which includes motorcycles), carpooling, vanpooling, public transit, bicycling, walking, telecommuting, and other. The results show that employees get to and from 86% of their workdays by personal vehicle. The second most popular mode of transportation was walking or biking with a combined (7.7%), followed by carpooling with 3.5% of the total.

TABLE 4-3: DAYS OF CITY EMPLOYEE TRAVEL BY COMMUTE MODE

Mode of Travel	Days Traveled by Commute Mode	% of Total
Drive Alone	11,648	86.2%
Carpool	468	3.5%
Vanpool	0	0%
Public transit	156	1.2%
Bicycle	468	3.5%
Walk	572	4.2%
Telecommute	208	1.5%
Total	13,520	100%

These figures for commute mode were combined with each respondent's travel distance to work, car model (if any), and fuel type (if any). The results show vehicle miles traveled (VMT) annually per vehicle type and fuel type (see **Table 4-4**). These VMT numbers were then adjusted for the total employee population in 2005 and entered into the CACP2009 software to obtain CO₂e.

Driving patterns were assumed to be constant for the purposes of this study; therefore, the 2009 sample was applied directly to the 2005 employee population. Only one modification to the sample data was made in order to account for the large increase in hybrid car sales between

GREENHOUSE GAS EMISSIONS

INVENTORY UPDATE

2005 and 2009. The proportion of hybrid to traditional vehicles was roughly two-thirds less in 2005 than in 2009, according to state sales data.²³

The 2009 survey results, adjusted for 2005 employee totals, resulted in an estimated 253 metric tons CO₂e in 2005 from commuter travel to and from work. This figure comprises approximately 25.5% of total GHG emissions released from City government operations.

TABLE 4-4: EMPLOYEE COMMUTE VMT BY VEHICLE AND FUEL TYPE

Vehicle Group	2009 Survey Results		Adjusted for 2005	
	Annual VMT	Fuel Type	Annual VMT	Fuel Type
Light Truck/SUV/Pickup	64,311.85	Gasoline	122,771.32	Gasoline
	0	Diesel	0	Diesel
Large Truck	23,220.10	Gasoline	44,327.17	Gasoline
	0	Diesel	0	Diesel
Passenger Vehicle	81,317.31	Gasoline	158,621.54	Gasoline
	2,348.10	Diesel	4,482.52	Diesel
Total	171,197.36		330,202.56	

Employee business travel on behalf of the local government in vehicles that are not owned or maintained by the local government is usually included in a City government GHG Inventory per LGOP version 1.1. This includes emissions associated with personal and rented vehicles, mass transit, marine and air travel; however, this could not be included in this baseline analysis because the City does not maintain records of employee travel destination or mode. As such, this Inventory could not accurately account for GHG emissions from employee business travel.

To estimate emissions associated with employee business travel for future inventories, it is recommended that records of employee travel destination, distance, mode, and the date be kept.

²³ www.hybridcars.com

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

4.5 STREETLIGHTS AND TRAFFIC SIGNALS

The electricity consumed by City streetlights and traffic signals in calendar year 2005 resulted in approximately 135 metric tons of CO₂e, or approximately 11.0% of total City government emissions. This Inventory accounts for approximately 34 streetlights and traffic signals.

4.6 WATER AND WASTEWATER

In 2005, electricity consumption from water and wastewater facilities in the City emitted approximately 285 metric tons of CO₂e, or 23.2% of total emissions. This category includes energy use at the numerous lift stations, pumps and wells that are necessary to convey water to serve all city residents as well as municipal irrigation systems.

4.7 WASTE

Similar to the Community-Wide analysis, waste produced by City facilities was calculated using the methane commitment method. The CACP2009 calculates the methane expected to be released from this landfilled waste over the course of its lifetime. In 2005, City facilities sent a total of 22.9 tons of waste to landfills, producing 8 metric tons of CO₂e, or 0.7% of total emissions. Unlike other sectors analyzed, the emissions from waste disposed of in 2005 will occur over multiple years as the waste breaks down over time.

4.8 OTHER – MISCELLANEOUS EQUIPMENT

The “other” category encompasses emissions from miscellaneous equipment such as general service equipment and equipment used at park facilities. This equipment resulted in 12 metric tons of carbon dioxide, and 1.0% of total emissions.

Emissions from miscellaneous City equipment were analyzed outside of the CACP2009 software using the California Air Resources Board protocol for inventorying local GHGs. Emissions were then put into the CACP2009 software in the “other” category, which allows for direct inputs when CACP2009 automation is not feasible.

4.9 CITY EMISSIONS BY SOURCE

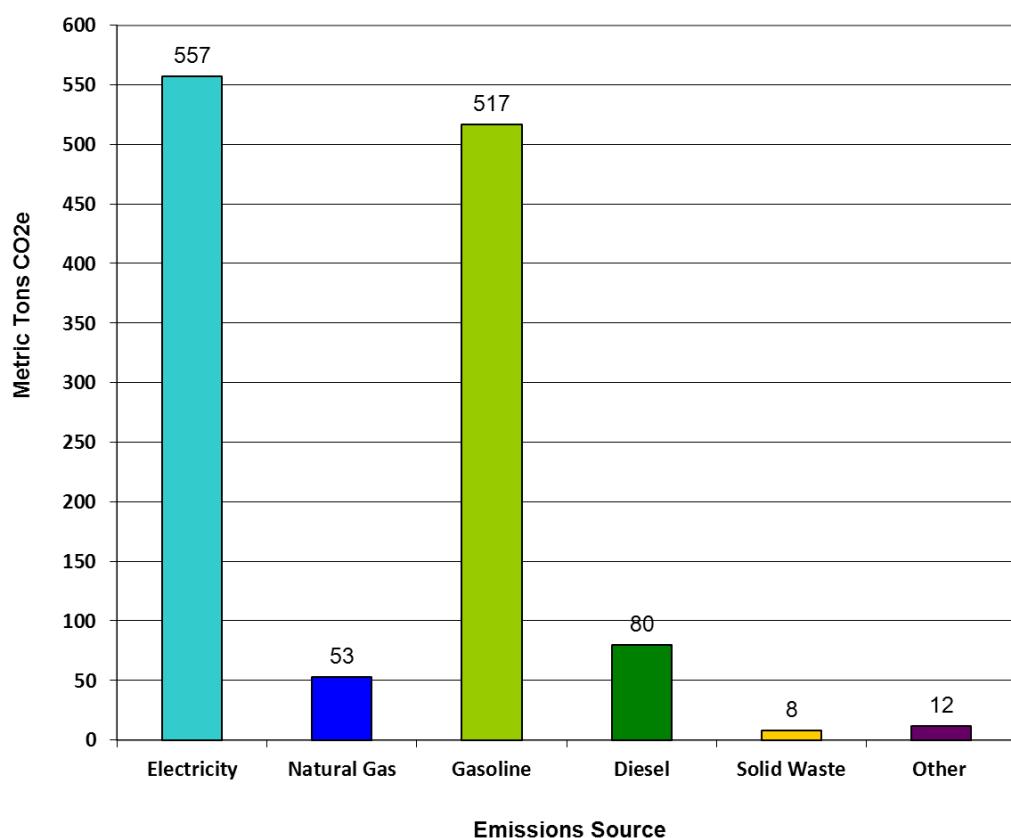
It can also be helpful to view overall City government emissions by source. As shown in **Table 4-5** and **Figure 4-5**, the majority of emissions are from electricity (45.4%) consumption in City-owned buildings, streetlights, and water/sewage facilities, gasoline (42.1%) consumed by the vehicle fleet and employee commute, and diesel (6.5%), also consumed by the vehicle fleet and employee commute. Natural gas, solid waste and miscellaneous equipment contributed in decreasing amounts to the remaining 6.0% of the overall City GHG emissions.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

TABLE 4-5: CITY GOVERNMENT GHG EMISSIONS BY SOURCE, 2005

City Emissions 2005 by Source	CO₂e (metric tons)	CO₂e (percentage of total)
Electricity	557	45.4%
Natural Gas	53	4.3%
Gasoline	517	42.1%
Diesel	80	6.5%
Solid Waste Decomposition	8	0.7%
Other	12	1.0%
TOTAL	1,227	100.0%

FIGURE 4-5: CITY GOVERNMENT GHG EMISSIONS BY SOURCE, 2005

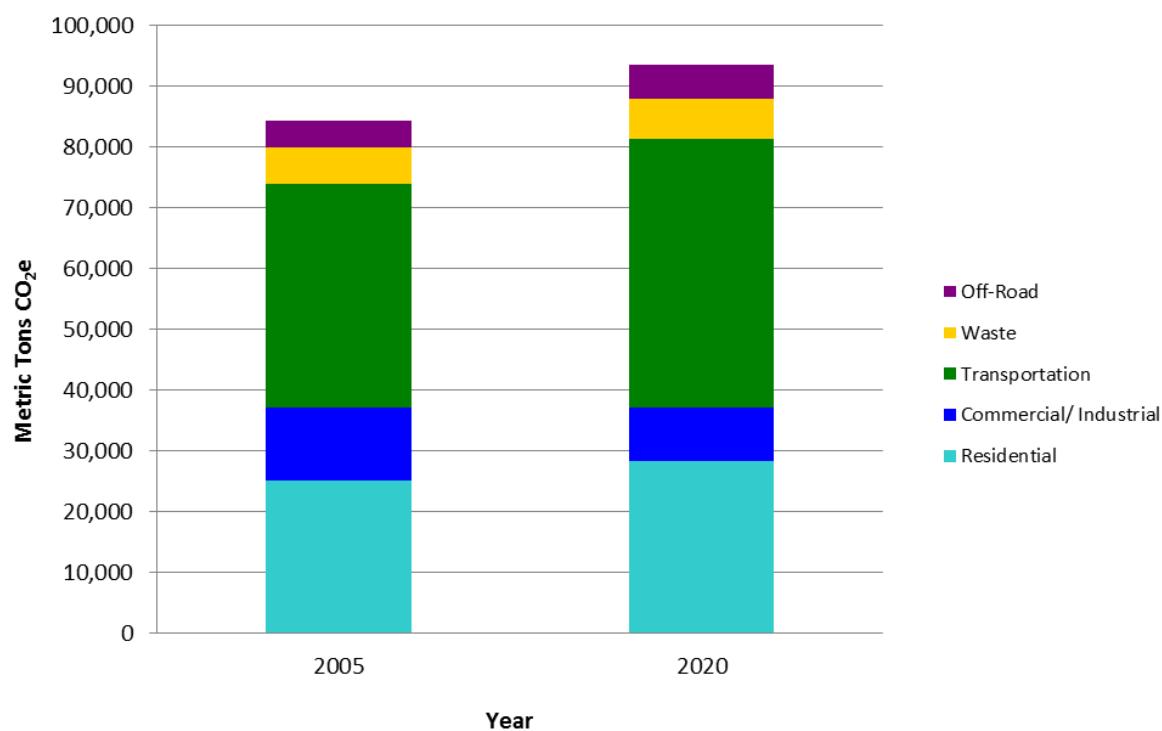


GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

5. Forecast

The emissions forecast for the City of Arroyo Grande represents a business-as-usual projection of how community-wide GHG levels would change over time if consumption trends and behavior continue as they did in 2005. These projections are based on the community inventory results included in this report and statistics on job and population growth from the 2040 Regional Growth Forecast.²⁴ The analysis (refer to **Figure 5-1**) shows that if behavior and consumption trends continue as business-as-usual, emissions will reach 93,513 metric tons of CO₂e by 2020, or a 10.8% increase over 2005 baseline levels.

**FIGURE 5-1: 2020 BUSINESS-AS-USUAL PROJECTED GROWTH IN
COMMUNITY-WIDE EMISSIONS**



The forecast does not quantify emissions reductions from state or federal activities including AB 32, the renewable portfolio standard, and SB 375. Additionally, it does not take into account

²⁴ SLOCOG's 2040 Population, Housing & Employment Forecast includes population, housing, and employment projections developed based on an analysis of historic growth and economic trends. See *San Luis Obispo County 2040 Population, Housing & Employment Forecast* (August 2011) for details.

GREENHOUSE GAS EMISSIONS

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reduction activities already under way or completed since 2005, the results of which likely put the community's emissions on a track well below the business-as-usual linear projection.

Forecasts were performed by applying job and population growth rates to 2005 community-wide GHG emissions levels. Baseline data and estimated growth were obtained from the using the SLOCOG 2040 Population, Housing & Employment Forecast (August 2011). The "mid-range" cases for population and job growth were used in this forecast estimation. Baseline data from this report is consistent with the San Luis Obispo APCD's GHG thresholds.

City government operations emissions are not separately analyzed as part of this forecast due to a lack of reasonable growth indicators for the City government sector. However, an increase in emissions is not expected for existing facilities and operations in the City government operations sector. If anything, the City expects that emissions within the scope of the 2005 City government operations inventory will decrease because of energy efficiency improvements, fleet upgrades, and the consolidation of Fire and Police Services with adjacent jurisdictions. At the same time, it is likely the City will have to expand services and infrastructure to accommodate the expected growth in the region, which could add new sources of emissions to the City government operations inventory that did not exist in 2005.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

6. Conclusion and Next Steps

The City of Arroyo Grande has made a formal commitment to reduce its GHG emissions. This report lays the groundwork for those efforts by estimating baseline emission levels against which future progress can be demonstrated.

This analysis found that the community was responsible for emitting 84,399 metric tons of CO₂e in the base year 2005, with the transportation sector contributing the most (43.7%) to this total. As a component of the community-wide analysis, City government operations produced 1,227 metric tons of CO₂e, or 1.5% of the total. In addition to establishing the baseline for tracking progress over time, this report serves to identify the major sources of city emissions, and therefore the greatest opportunities for emissions reductions. In this regard, the emissions inventory will inform the focus of the City's Climate Action Plan. If no action is taken, this report found that business-as-usual emissions will likely rise by 10.8% by 2020.

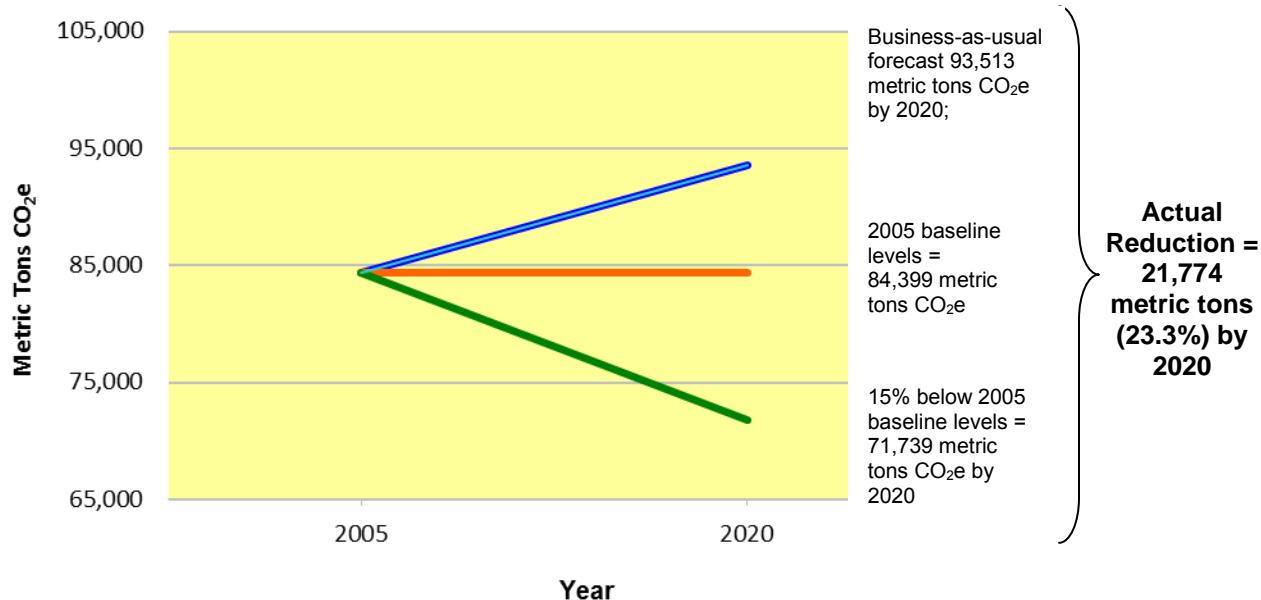
It is important to note that in order to remain consistent with GHG reduction methodology, all future quantifications of reduction activities must be subtracted from this business-as-usual line. Not doing so would be assuming that emissions remain at constant 2005 levels while reduction activities are under way. In reality, the City's climate action efforts will be working against a rising emissions level due to job and population growth. **Figure 6-1** below shows the business-as-usual emissions forecast in relation to 2005 baseline levels and the 15% reduction below 2005 levels recommended by the California Attorney General and Air Resources Board.²⁵

The difference between the business-as-usual forecast and the reduction targets is 23.3% in 2020. As noted in the Forecast section of this report, it is likely that the City's sustainability efforts have already caused emissions to fall below the business-as-usual linear projection line, thus making the 21,774 metric tons CO₂e reduction by 2020 achievable.

²⁵ The AB 32 Climate Change Scoping Plan Document prepared by the Air Resources Board calls for reducing GHG emissions to 1990 levels by cutting approximately 30 percent from business-as-usual emission levels projected for 2020, or about 15 percent from today's levels.

GREENHOUSE GAS EMISSIONS INVENTORY UPDATE

FIGURE 6-1: GHG FORECAST IN RELATION TO REDUCTION TARGET



As the City moves forward to the next milestones in the process, including designation of emissions reduction targets and development of a Climate Action Plan, the City should identify and quantify the emissions reduction benefits of projects that have already been implemented since 2005. The benefits of existing strategies can be tallied against the baseline established in this report to determine the appropriate set of strategies that will deliver the City to its chosen emissions reduction goal.

APPENDIX A:
**CACP DETAILED REPORT FOR COMMUNITY-
WIDE EMISSIONS, 2005**

Community Greenhouse Gas Emissions in 2005

Detailed Report

	CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)
Residential						
San Luis Obispo APCD, CA						
1 SoCal Gas Company - Residential						
Natural Gas	16,316	31	1,538	16,358	19.4	307,505
<i>Subtotal 1 SoCal Gas Compan</i>	<i>16,316</i>	<i>31</i>	<i>1,538</i>	<i>16,358</i>	<i>19.4</i>	<i>307,505</i>
Natural gas data provided by Paulo Morais, Customer Programs Environmental Affairs, Southern California Gas Co. (213) 244-3246, pmorais@semprautilities.com <mailto:pmorais@semprautilities.com>, May 2012.						
CEC Emission Factor for Natural Gas - RCI Average Set from Local Government Operations Protocol version 1.1 (LGOP v1.1). Fuel CO2 set provided by Southern California Gas Co for San Luis Obispo area.						
<i>2 PG&E Residential Electricity</i>						
Electricity	8,675	195	532	8,747	10.4	133,487
<i>Subtotal 2 PG&E Residential E</i>	<i>8,675</i>	<i>195</i>	<i>532</i>	<i>8,747</i>	<i>10.4</i>	<i>133,487</i>
Electricity data provided by Jillian Rich, jillian.rich@pge.com <mailto:jillian.rich@pge.com> and John Joseph, ghgdatarequests@pge.com <mailto:ghgdatarequests@pge.com>, PG&E.						
The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO2 emission factor of 0.489 lbs/kWh of delivered electricity as update on June 27, 2011 and provided by PG&E. PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009). Criteria air pollutant emission factors for electricity were obtained from the LGOP v1.1 for California.						
Subtotal Residential	24,991	226	2,070	25,105	29.7	440,993
Commercial						
San Luis Obispo APCD, CA						
1 SoCal Gas Company - Commercial						
Natural Gas	4,175	8	393	4,186	5.0	78,682
<i>Subtotal 1 SoCal Gas Compan</i>	<i>4,175</i>	<i>8</i>	<i>393</i>	<i>4,186</i>	<i>5.0</i>	<i>78,682</i>
Electricity data provided by Jillian Rich, jillian.rich@pge.com <mailto:jillian.rich@pge.com> and John Joseph, ghgdatarequests@pge.com <mailto:ghgdatarequests@pge.com>, PG&E.						
Natural gas data provided by Paulo Morais, Customer Programs Environmental Affairs, Southern California Gas Co. (213) 244-3246, pmorais@semprautilities.com <mailto:pmorais@semprautilities.com>, May 2012.						
The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO2 emission factor of 0.489 lbs/kWh of delivered electricity as update on June 27, 2011 and provided by PG&E. PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009). Criteria air pollutant emission factors for electricity were obtained from the LGOP v1.1 for						

Community Greenhouse Gas Emissions in 2005

Detailed Report

CO₂ (tonnes)	N₂O (kg)	CH₄ (kg)	Equiv CO₂ (tonnes)	(%)	Energy (MMBtu)
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California.

CEC Emission Factor for Natural Gas - RCI Average Set from Local Government Operations Protocol version 1.1 (LGOP v1.1). Fuel CO2 set provided by Southern California Gas Co for San Luis Obispo area.

2 PG&E Commercial + Industrial Electricity

Electricity	7,683	173	471	7,746	9.2	118,213
<i>Subtotal 2 PG&E Commercial</i>	<i>7,683</i>	<i>173</i>	<i>471</i>	<i>7,746</i>	<i>9.2</i>	<i>118,213</i>

Electricity data provided by Jillian Rich, jillian.rich@pge.com <<mailto:jillian.rich@pge.com>> and John Joseph, ghgdatarequests@pge.com <<mailto:ghgdatarequests@pge.com>>, PG&E.

Natural gas data provided by Paulo Morais, Customer Programs Environmental Affairs, Southern California Gas Co. (213) 244-3246, pmorais@semprautilities.com <<mailto:pmorais@semprautilities.com>>, May 2012.

The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO2 emission factor of 0.489 lbs/kWh of delivered electricity as update on June 27, 2011 and provided by PG&E. PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009). Criteria air pollutant emission factors for electricity were obtained from the LGOP v1.1 for California.

CEC Emission Factor for Natural Gas - RCI Average Set from Local Government Operations Protocol version 1.1 (LGOP v1.1). Fuel CO2 set provided by Southern California Gas Co for San Luis Obispo area.

Subtotal Commercial	11,857	181	865	11,932	14.1	196,895
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Waste

San Luis Obsipo APCD, CA

<i>3 Community Solid Waste - Cold Canyon</i>					<i>Disposal Method - Managed Landfill</i>
Paper Products	0	0	153,378	3,221	3.8
Food Waste	0	0	60,152	1,263	1.5
Plant Debris	0	0	16,141	339	0.4
Wood or Textiles	0	0	45,042	946	1.1
<i>Subtotal 3 Community Solid W.</i>	<i>0</i>	<i>0</i>	<i>274,713</i>	<i>5,769</i>	<i>6.8</i>

Source:

1. Total waste tonnage for the City in 2005 provided by the 2005 Disposal Quarterly Reports prepared by San Luis Obispo County Integrated Waste Management Authority on 6/17/05, 9/27/05, 12/27/05 and 3/6/06, provided by Peter Cron, pcron@iwma.com.

2. Percentages of waste share by type for landfill tonnage provided by CIWMB 2004 Statewide Waste Characterization Study. <http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097>

Notes:

1. Waste Type data not collected by landfill. State average waste characterization data is used for residential, commercial and self haul waste.

Community Greenhouse Gas Emissions in 2005

Detailed Report

CO₂ (tonnes)	N₂O (kg)	CH₄ (kg)	Equiv CO₂ (tonnes)	Energy (MMBtu)
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2. Chicago Grade landfill reports a methane recovery factor of 60%. Chicago Grade total gas generated = 157.47 mmcf/yr. Total gas transferred = 94.48 mmcf/yr.

3. Cold Canyon landfill reports a methane recovery factor of 60%. Cold Canyon total gas generated = 700 mmcf/yr. Total gas transferred = 420 mmcf/yr.

<i>3 Community Solid Waste-Chicago Grade</i>					<i>Disposal Method - Managed Landfill</i>
Paper Products	0	0	3,707	78	0.1
Food Waste	0	0	1,454	31	0.0
Plant Debris	0	0	390	8	0.0
Wood or Textiles	0	0	1,089	23	0.0
<i>Subtotal 3 Community Solid W.</i>	<i>0</i>	<i>0</i>	<i>6,640</i>	<i>139</i>	<i>0.2</i>

Source(s):

1. Total waste tonnage for the City in 2005 provided by the 2005 Disposal Quarterly Reports prepared by San Luis Obispo County Integrated Waste Management Authority on 6/17/05, 9/27/05, 12/27/05 and 3/6/06, provided by Peter Cron, pcron@iwma.com.

2. Percentages of waste share by type for landfill tonnage provided by CIWMB 2004 Statewide Waste Characterization Study. <http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097>

Notes:

1. Waste Type data not collected by landfill. State average waste characterization data is used for residential, commercial and self haul waste.

2. Chicago Grade landfill reports a methane recovery factor of 60%. Chicago Grade total gas generated = 157.47 mmcf/yr. Total gas transferred = 94.48 mmcf/yr.

3. Cold Canyon landfill reports a methane recovery factor of 60%. Cold Canyon total gas generated = 700 mmcf/yr. Total gas transferred = 420 mmcf/yr.

Subtotal Waste	0	0	281,353	5,908	7.0
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Other

San Luis Obispo APCD, CA

1 - Off-Road Vehicles & Equipment

Carbon Dioxide	4,555	0	0	4,555	5.4
<i>Subtotal 1 - Off-Road Vehicles</i>	<i>4,555</i>	<i>0</i>	<i>0</i>	<i>4,555</i>	<i>5.4</i>

Off-road vehicle and equipment emissions obtained from the California Air Resources Boards' OFFROAD2007 software. Emissions were calculated for construction equipment based on the city's share of countywide construction jobs, lawn & garden equipment based on the city's share of countywide households, industrial equipment based on the city's share of countywide industrial sector jobs, light commercial equipment based on the

Community Greenhouse Gas Emissions in 2005

Detailed Report

	CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)
city's share of countywide commercial sector jobs, and agricultural equipment based on the city's share of countywide agricultural land. Household and job data obtained from the U.S. Census Bureau and agricultural data obtained from County GIS files.						
<i>1 - On-Road Transportation</i>						
Carbon Dioxide	36,897	0	0	36,897	43.7	
<i>Subtotal 1 - On-Road Transpor</i>	<i>36,897</i>	<i>0</i>	<i>0</i>	<i>36,897</i>	<i>43.7</i>	
Sources:						
<ul style="list-style-type: none"> Average weekday vehicle miles traveled (VMT) were provided by Fehr & Peers, July 2012, using the San Luis Obispo Regional Travel Demand model. Transportation-related GHG emissions (carbon dioxide, methane, and nitrous oxide) were calculated using California Air Resources Board's Emissions Factor (EMFAC2011) software and converted to CO₂e. 						
Notes:						
<ul style="list-style-type: none"> Using origin-destination analysis, three types of vehicle trips were tracked separately for AM and PM peak periods in the City: <ol style="list-style-type: none"> Internal-Internal: Vehicle trips that remained inside the city Internal-External and External-Internal: Vehicle trips that have an ending or a beginning in the city External-External: Vehicle trips that pass through the city without originating or ending in the city Using the recommendation of the Regional Target Advisory Committee (RTAC), the body responsible for Senate Bill 375 target setting, vehicle miles traveled (VMT) from trips of type 1, 2, and 3 were counted 100%, 50%, and 0% respectively toward jurisdiction-generated VMT. Transportation-related greenhouse gas emissions were calculated using the EMFAC2011 software. EMFAC2011 provides carbon dioxide, methane, and nitrous oxide emissions according to the unique vehicle composition of each county in California. Of the total on-road transportation emissions 93.2% are the result of gasoline consumption and 6.8% are the result of diesel fuel consumption. 						
Subtotal Other	41,452	0	0	41,452	49.1	
Total	78,301	407	284,287	84,397	100.0	637,888

APPENDIX B:
CACP DETAILED REPORT FOR CITY
GOVERNMENT OPERATIONS EMISSIONS,
2005

Government Greenhouse Gas Emissions in 2005

Detailed Report

CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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Buildings and Facilities

San Luis Obispo APCD, CA

All Buildings and Facilities

Electricity	136	3	8	137	21.4	2,097	0
Natural Gas	53	0	5	53	8.3	997	0
<i>Subtotal All Buildings and Faci.</i>	189	3	13	190	29.6	3,095	0

Revised Inventory Notes:

Updated natural gas data provided by Paulo Morais, Customer Programs Environmental Affairs (213) 244-3246, pmorais@semprautilities.com, May 2012.

Update electricity data provided by Jillian Rich, jillian.rich@pge.com and John Joseph, ghgdatarequests@pge.com, PG&E, May 2012.

1. The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO₂ emission factor of 0.489 lbs/kWh of delivered electricity as update on June 27, 2011 and provided by PG&E. PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009).

Original Sources:

1. All records were provided by Finance Department.
2. Tricia Meyers, Accounts Payable (tmeyers@arroyogrande.org) (805-473-5420 ext. 5436)

Notes:

1. Police Station SoCal Gas Account Number:093-015-0800-9, PG&E Account Number: 8532998230.

Subtotal Buildings and Facilities	189	3	13	190	29.6	3,095	0
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Streetlights & Traffic Signals

San Luis Obispo APCD, CA

All Street lights and Traffic Control

Electricity	134	3	8	135	21.0	2,062	0
<i>Subtotal All Street lights and Ti</i>	134	3	8	135	21.0	2,062	0

Revised Inventory Notes:

Updated natural gas data provided by Paulo Morais, Customer Programs Environmental Affairs (213) 244-3246, pmorais@semprautilities.com, May 2012.

Update electricity data provided by Jillian Rich, jillian.rich@pge.com and John Joseph, ghgdatarequests@pge.com, PG&E, May 2012.

1. The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO₂ emission factor of 0.489 lbs/kWh of delivered electricity as update on June 27, 2011 and provided by PG&E. PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009).

Government Greenhouse Gas Emissions in 2005

Detailed Report

CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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Original Source:

1. All records were provided by Finance Department.
2. Tricia Meyers, Accounts Payable (tmeyers@arroyogrande.org) (805-473-5420 ext. 5436)

Notes:

1. Street Lights: PG&E ID #: 8892110005 10-4312-252, 1940974026, 1940974028, 6208387003, 2350444653, 1903183645, 1940974002, 1940974004, 1940974008, 1940974014, 1940974016, 1940974022, 190979002. 190979004.

Subtotal Streetlights & Traffic Signals	134	3	8	135	21.0	2,062	0
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Water Delivery Facilities**San Luis Obispo APCD, CA***All Water Delivery Facilities*

Electricity	253	6	16	255	39.7	3,891	0
Subtotal All Water Delivery Facilities	253	6	16	255	39.7	3,891	0

Revised Inventory Notes:

Updated natural gas data provided by Paulo Morais, Customer Programs Environmental Affairs (213) 244-3246, pmorais@semprautilities.com, May 2012.

Update electricity data provided by Jillian Rich, jillian.rich@pge.com and John Joseph, ghgdatarequests@pge.com, PG&E, May 2012.

1. The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO₂ emission factor of 0.489 lbs/kWh of delivered electricity as update on June 27, 2011 and provided by PG&E. PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009).

Original Sources:

1. All records were provided by Finance Department.
2. Tricia Meyers, Accounts Payable (tmeyers@arroyogrande.org) (805-473-5420 ext. 5436)

Notes:

1. Irrigation PG&E Account Numbers: 8532998330 10-4320-251, 8532998265, 8532998070, 8532998370 10-4320-251, 8532998300 10-4320-251, 8532998295 10-4320-251, 8532998210 10-4320-251, 8532998155, 8532998068 10-4320-251, 8532998030 10-4320-251.
2. Irrigation totals include all irrigation including sprinklers and irrigation controls.

Subtotal Water Delivery Facilities	253	6	16	255	39.7	3,891	0
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Wastewater Facilities**San Luis Obispo APCD, CA***All Wastewater Facilities*

Electricity	30	1	2	30	4.7	460	0
Natural Gas	0	0	0	0	0.0	0	0
Subtotal All Wastewater Facilities	30	1	2	30	4.7	461	0

Revised Inventory Notes:

Government Greenhouse Gas Emissions in 2005

Detailed Report

CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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Updated natural gas data provided by Paulo Morais, Customer Programs Environmental Affairs (213) 244-3246, pmorais@semprautilities.com, May 2012.

Update electricity data provided by Jillian Rich, jillian.rich@pge.com and John Joseph, ghgdatarequests@pge.com, PG&E, May 2012.

1. The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO2 emission factor of 0.489 lbs/kWh of delivered electricity as update on June 27, 2011 and provided by PG&E. PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009).

Original Sources:

1. All records were provided by Finance Department.
2. Tricia Meyers, Accounts Payable (tmeyers@arroyogrande.org) (805-473-5420 ext. 5436)

Notes:

1. Lift Station PG&E Account Numbers: 85329980320 12-4400-252 LIFT ST#4, 2998345 12-4400-252-LFT.STA.#3, 8532998135 W/SPRC ST 10-4321-2510F-LT-PRT.

Subtotal Wastewater Facilities	30	1	2	30	4.7	461	0
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Solid Waste Facilities

San Luis Obispo APCD, CA

3 City Operations Generated Waste

Carbon Dioxide	8	0	0	8	1.2	0	4,768
<i>Subtotal 3 City Operations Ger</i>	8	0	0	8	1.2	0	4,768

Sources:

1. All records were provided by finance department.
2. Tricia Meyers, Accounts Payable (tmeyers@arroyogrande.org) (805-473-5420 ext. 5436)
3. Referring to Cold Canyon and South County Sanitary landfills with a recovery factor of 60%.

Notes:

1. Waste type data not collected by Cold Canyon and South County Sanitary landfills. State average waste characterization data was used for residential, commercial and self haul waste.
2. Weekly cubic yard collection data was converted to tonnage at the rate of 325 lbs per cubic yard.

Subtotal Solid Waste Facilities	8	0	0	8	1.2	0	4,768
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Vehicle Fleet

San Luis Obispo APCD, CA

1 Building Department

Gasoline	0	0	0	0	0.0	70	447
<i>Subtotal 1 Building Departmen</i>	0	0	0	0	0.0	70	447

Sources:

1. All records were provided by the City Clerk and the City Yard.
2. Kelly Wetmore, City Clerk (kwetmore@arroyogrande.org) (805-473-5420 ext. 5414/5416), Glenda Boner, City Yard Office Assistant (gboner@arroyogrande.org) (805-473-5460 ext. 5460)

Government Greenhouse Gas Emissions in 2005

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CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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Notes:

1. Building Department fleet. All of the fleet are light trucks.
2. Due to the very limited amount of fleet data for the City in 2005, 2007 is used as the proxy year. There were no significant changes in this time period.

1 Fire Department

Diesel	0	0	0	0	0.0	384	8,284
Gasoline	0	1	1	0	0.0	194	4,637
<i>Subtotal 1 Fire Department</i>	0	1	1	0	0.0	579	12,921

Sources:

1. All records were provided by the City Clerk and the City Yard.
2. Kelly Wetmore, City Clerk (kwetmore@arroyogrande.org) (805-473-5420 ext. 5414/5416). Glenda Boner, City Yard Office Assistant (gboner@arroyogrande.org) (805-473-5460 ext. 5460)

Notes:

1. Fire Department fleet. Most all of the fleet vehicles are diesel heavy duty trucks and fire engines except for one diesel light truck.
2. Due to the very limited amount of fleet data for the City in 2005, 2007 is used as the proxy year. Therefore all vehicles (one heavy duty truck) that were made in 2005 to 2007 are placed in the 2005 category. There were no significant changes in this time period.

1 Parks Department

Diesel	0	0	0	0	0.0	209	2,590
Gasoline	0	2	1	1	0.1	464	19,425
<i>Subtotal 1 Parks Department</i>	0	2	1	1	0.1	673	22,015

Sources:

1. All records were provided by the City Clerk and the City Yard.
2. Kelly Wetmore, City Clerk (kwetmore@arroyogrande.org) (805-473-5420 ext. 5414/5416). Glenda Boner, City Yard Office Assistant (gboner@arroyogrande.org) (805-473-5460 ext. 5460)

Notes:

1. Parks department fleet. Almost all vehicles run on unleaded gasoline except one diesel light truck.
2. Due to the very limited amount of fleet data for the City in 2005, 2007 is used as the proxy year. Therefore all vehicles (one heavy duty truck and one light truck) that were made in 2005 to 2007 are placed in the 2005 category. There were no significant changes in this time period.
3. Parks Department off-highway equipment use. There are three documented off-highway equipment uses that use diesel: P-11, P-4 and P-405.

1 Police Department

Diesel	0	0	0	0	0.0	49	30
Gasoline	0	3	4	1	0.2	2,007	49,924
<i>Subtotal 1 Police Department</i>	0	3	4	1	0.2	2,057	49,954

Sources:

1. All records were provided by the City Clerk and the City Yard.
2. Kelly Wetmore, City Clerk (kwetmore@arroyogrande.org) (805-473-5420 ext. 5414/5416). Glenda Boner, City Yard Office Assistant

Government Greenhouse Gas Emissions in 2005

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CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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(gboner@arroyogrande.org) (805-473-5460 ext. 5460)

Notes:

1. Police Department fleet. All vehicles run on unleaded gasoline.
2. Due to the very limited amount of fleet data for the City in 2005, 2007 is used as the proxy year. Therefore all vehicles that were made in 2005 to 2007 are placed in the 2005 category. There were no significant changes in this time period.

1 Public Works Fleet

Diesel	0	0	0	0	0.0	423	11,433
Gasoline	0	4	3	1	0.2	1,132	30,168
<i>Subtotal 1 Public Works Fleet</i>	0	4	3	1	0.2	1,555	41,601

Sources:

1. All records were provided by the City Clerk and the City Yard.
2. Kelly Wetmore, City Clerk (kwetmore@arroyogrande.org) (805-473-5420 ext. 5414/5416). Glenda Boner, City Yard Office Assistant (gboner@arroyogrande.org) (805-473-5460 ext. 5460)

Notes:

1. Public Works fleet. Since CACP software inventory years for vehicle fleet start at 1985, all vehicles (one light truck and one heavy duty truck), that were made before 1985 are logged in as 1985.
2. Due to the very limited amount of fleet data for the City in 2005, 2007 is used as the proxy year. Therefore all vehicles (light trucks and heavy duty trucks) that were made in 2005 to 2007 are placed in the 2005 category. There were no significant changes in this time period.
3. Public Works off-highway equipment use. There are ten documented off-highway equipment uses that use diesel: PW-1, PW-9, PW-12, PW-38, PW-55, PW-111, PW-243, PW-249, PW-282, and PW-398.

Subtotal Vehicle Fleet	0	10	10	3	0.5	4,933	126,937
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Employee Commute

San Luis Obispo APCD, CA

3 Employee Commute

Diesel	0	0	0	0	0.0	29	0
Gasoline	0	18	144	9	1.4	3,567	0
<i>Subtotal 3 Employee Commute</i>	0	18	144	9	1.4	3,596	0

Sources:

1. Employee commute survey, conducted in September 2009 and adjusted for 2005 employment figures. Survey data manipulated by Jaime Hill, jhill@pmcworld.com.
2. 2005 and 2009 City employment figures obtained from Kelly Heffernon, Associate Planner, kheffernon@arroyogrande.org.
3. Hybrid fuel economy of a 2005 Toyota Prius, www.fueleconomy.gov.

Notes:

1. 55 City employees successfully responded to the online survey or on paper, meaning that all essential entries were given.
2. Survey responses were adjusted for the 2005 employee population, assuming constant distribution of gasoline/diesel consumption by vehicle type. The population of hybrid cars was decreased by 2/3, based on California sales records found at www.hybridcars.com.
3. For more detailed information on the methodology used in this sector, please see the appendices.

Government Greenhouse Gas Emissions in 2005

Detailed Report

	CO ₂ (tonnes)	N ₂ O (kg)	CH ₄ (kg)	Equiv CO ₂ (tonnes)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
Subtotal Employee Commute	0	18	144	9	1.4	3,596	0
Other Process Fugitive							
San Luis Obsipo APCD, CA							
1 Off Road Equipment							
Carbon Dioxide	12	0	0	12	1.9		
Methane	0	0	1	0	0.0		
Nitrous Oxide	0	0	0	0	0.0		
Subtotal 1 Off Road Equipment	12	0	1	12	1.9		
Sources:							
1. 2007 Vehicle Fleet/Equipment data in the form of monthly fuel purchase receipts and vehicle/equipment make, model, and year received from the City Clerk and the City Yard.							
2. Kelly Wetmore, City Clerk (kwetmore@arroyogrande.org) (805-473-5420 ext. 5414/5416). Glenda Boner, City Yard Office Assistant (gboner@arroyogrande.org) (805-473-5460 ext. 5460)							
3. Raw data in gallons of fuel used, and converted to CO ₂ e based on the following Emissions factors (from Table G.9 and G.12 of CARB Local Government Operations Protocol, September 2008).							
4. Diesel = 10.15 kg CO ₂ , 0.26 grams N ₂ O and 0.58 grams CH ₄ per gallon							
5. Vehicle fleet/equipment data manipulated by Jaime Hill (805-250-7973, jhill@PMCWorld.com).							
Notes:							
1. All off road equipment used by the Public Works, Parks, and Fire Departments.							
2. Due to lack of complete 2005 data, the first full calendar year for which data was available was 2007.							
3. Total of 1,175.30 gallons diesel = 11,929.3 kg CO ₂ , 305.58 grams N ₂ O and 681.67 grams CH ₄ .							
Subtotal Other Process Fugitive	12	0	1	12	1.9		
Total	626	41	194	643	100.0	18,037	131,705

APPENDIX C:
DETAILED METHODOLOGY FOR
COMMUNITY-WIDE INVENTORY

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

Detailed Methodology for Community-Wide Inventory

This appendix provides the detailed methodology and data sources used for calculating GHG emissions in each sector of the community-wide inventory.

OVERVIEW OF INVENTORY CONTENTS AND APPROACH

The community inventory methodology is based on guidance from ICLEI International Local Government GHG Emissions Analysis Protocol (IEAP) (October 2009) and the Association of Environmental Professionals California Community-wide GHG Baseline Inventory Protocol (AEP Protocol) (June 2011). The community inventory identifies and quantifies emissions from the residential, commercial/industrial, transportation, off-road, and solid waste sectors. Emissions are calculated by multiplying activity data—such as kilowatt hours or gallons of gasoline consumed—by emissions factors, which provide the quantity of emissions per unit of activity. Activity data is typically available from electric and gas utilities, planning and transportation agencies and air quality regulatory agencies. Emissions factors are drawn from a variety of sources, including the California Climate Action Registry, the Local Governments Operations Protocol (LGOP) version 1.1 (May 2010), and air quality models produced by the California Air Resources Board.

In this inventory, all GHG emissions are converted into carbon dioxide equivalent units, or CO₂e, per guidance in the LGOP version 1.1, AEP Protocol, and IEAP. The LGOP provides standard factors to convert various greenhouse gases into carbon dioxide equivalent units; these factors are known as Global Warming Potential factors, representing the ratio of the heat-trapping ability of each greenhouse gas relative to that of carbon dioxide.

The following sections describe the specific data sources and methodology for calculating GHG emissions in each community sector.

RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SECTORS

All residential and commercial/industrial sector emissions are the result of electricity consumption and the on-site combustion of natural gas. Pacific Gas and Electric Company (PG&E) and Southern California Gas Company (SoCal Gas Co.) provided residential electricity and natural gas consumption data. Specifically, data was provided by:

- Jillian Rich, Program Manager with PG&E Green Communities and Innovator Pilots (jillian.rich@pge.com), and John Joseph, PG&E GHG Data Requests

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

- Paulo Morais, Energy Programs Supervisor with Southern California Gas Company, Customer Programs (pmorais@semprautilities.com)

The raw data received from PG&E and SoCal Gas Co. is summarized in **Tables 1 and 2** below. This raw data was input into the CACP2009 software in kWh and therms. PG&E provided a 2005 carbon dioxide (CO₂) coefficient for electricity use and SoCal Gas Co. provided a carbon dioxide (CO₂) coefficient for natural gas (see “electricity and natural gas coefficients” section). Emissions coefficients for methane (CH₄) and nitrogen dioxide (N₂O) emissions were provided by the California LGOP version 1.1 and were converted into carbon dioxide equivalents and added to the CO₂ emissions to obtain carbon dioxide equivalent (CO₂e) emissions.

All commercial/industrial sector emissions are the result of electricity consumption and the on-site combustion of natural gas. Commercial and industrial electricity were combined into one section by PG&E due to the California 15/15 Rule. The 15/15 Rule was adopted by the California Public Utilities Commission (CPUC) in the Direct Access Proceeding (CPUC Decision 97-10-031) to protect customer confidentiality. The 15/15 Rule requires that any aggregated information provided by the utilities must be made up of at least 15 customers. A single customer's load must be less than 15% of an assigned category. If the number of customers in the complied data is below 15, or if a single customer's load is more than 15% of the total data, categories must be combined before the information is released. The rule further requires that if the 15/15 Rule is triggered for a second time after the data has been screened already using the 15/15 Rule, the customer must be dropped from the information provided. As a result, PG&E aggregated commercial and industrial energy consumption into one report, whereas SoCal Gas Co. separated commercial and industrial gas usage (shown in the chart below) into two reports. It would have been misleading to present an “Industrial” category for only natural gas emissions; therefore, the SoCal Gas Co. emissions were aggregated with commercial as well.

TABLE 1: RESIDENTIAL ENERGY USE, 2005

2005 Residential Energy Emissions	Scope	Input Data	Metric Tons CO ₂ e per Year
PG&E Electricity	2	39,111,825 kWh	8,747
SoCal Gas Co. Natural Gas	1	3,075,052 Therms	16,358

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

TABLE 2: COMMERCIAL/INDUSTRIAL ENERGY USE, 2005

2005 Commercial / Industrial Energy Emissions	Scope	Input Data	Metric Tons CO ₂ e per Year
PG&E Commercial + Industrial Electricity	2	34,636,372 kWh	7,746
SoCal Gas Co. Commercial + Industrial Natural Gas	1	786,820 Therms	4,186

To make the Inventory more accurate and representative of the city's real impact on climate change, tailored coefficient sets were obtained from PG&E and the LGOP version 1.1. Sources and coefficient values are summarized in the table below.

TABLE 3: ELECTRICITY COEFFICIENT SETS

Coefficient Set	Unit	Value	Source
Average Grid Electricity Set	Lbs/ MWh	489 CO ₂ 0.011 N ₂ O 0.03 CH ₄	Jillian Rich, Program Manager with PG&E Green Communities and Innovator Pilots (jillian.rich@pge.com), and John Joseph, PG&E GHG Data Requests (ghgdatarequests@pge.com) and LGOP version 1.1

TABLE 4: NATURAL GAS COEFFICIENT SETS

Coefficient Set	Unit	Value	Source
Fuel CO ₂ (Natural Gas) Set	kg/MMBtu	53.06 CO ₂	Coefficient set provided by LGOP version 1.1
RCI Average Set – Residential	kg/MMBtu	0.0001 N ₂ O 0.005 CH ₄	Coefficient set provided by LGOP version 1.1
RCI Average Set – Commercial + Industrial	kg/MMBtu	0.0001 N ₂ O 0.005 CH ₄	Coefficient set provided by LGOP version 1.1

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

TRANSPORTATION SECTOR

On-road transportation emissions were derived from local jurisdiction vehicle miles traveled (VMT) data and regional vehicle and travel characteristics. The transportation analysis, conducted by Fehr & Peers, utilized the San Luis Obispo Council of Governments (SLOCOG) Regional Travel Demand model to develop transportation-related GHG emissions data and VMT for trips that have an origin and/or destination in the city.

The SLOCOG Travel Demand Model was recently updated and validated to reflect 2010 conditions and to comply with the Regional Transportation Plan (RTP) guidelines on implementation of Senate Bill 375 (SB 375). The update included expanding the times of day, calibration of multiple modes, and reflecting the auto and of non-auto RTP transportation system, all beneficial when quantifying potential GHG reduction strategies. A 2005 land use scenario was developed by extrapolating 2035 and 2010. Similarly, a 2020 land use scenario was developed by interpolating between 2010 and 2035. See *Summary for the San Luis Obispo Council of Governments Model Improvement Project to Meet the Requirements of California Transportation Commission Guidelines for Regional Transportation Plans in Response to SB375* (February, 2012) for details on model calibration and validation.

Using the model, Fehr & Peers allocated vehicle trips and VMT to each of the cities in San Luis Obispo County and the unincorporated county by weighting trips based on their origin and destination. The VMT summarized for land use with each of the incorporated cities and unincorporated county includes:

- a) All of the VMT associated with trips made completely internally within each jurisdiction;
- b) Half of the VMT generated by jobs and residences located within each jurisdiction but that travels to/from external destinations (this is consistent with the recent SB 375 Regional Targets Advisory Committee (RTAC) decision that the two generators of an inter-jurisdictional trip should each be assigned half of the responsibility for the trip and its VMT); and
- c) None of the responsibility for travel passing completely through the jurisdiction with neither an origin point, or a destination within the city (also consistent with RTAC decision).

The gateways exiting the model area were included in the VMT calculation. This means that a jurisdiction will be held responsible for some VMT occurring outside of the model borders. For

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

example, if a household in Pismo Beach travels across the Santa Maria Bridge to Santa Barbara, or through San Luis Obispo City to reach King City.

To capture the effects of congestion, the model VMT for each time period were summarized by speed for each time period and then aggregated to daily. The VMT results are summarized in **Table 5** for the baseline year (2005) and **Table 6** for 2020.

TABLE 5: VEHICLE MILES TRAVELED PER JURISDICTION, 2005

Vehicle Miles Traveled per Jurisdiction, 2005	Vehicle Miles Traveled (VMT)	
	Average Weekday Daily	Average Annual¹
Arroyo Grande	231,019	80,163,593
Atascadero	375,925	130,445,975
Grover Beach	116,140	40,300,580
Morro Bay	140,915	48,897,505
Paso Robles	424,515	147,306,705
Pismo Beach	324,400	112,566,800
San Luis Obispo	2,280,295	791,262,365
Unincorporated County	2,635,017	914,350,899
Total	6,528,226	2,265,294,422

¹ Average Annual VMT was calculated by applying a multiplier of 347 to average weekday daily VMT to account for the total number of weekdays in one year based on the recommendation from Caltrans.

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

TABLE 6: VEHICLE MILES TRAVELED PER JURISDICTION, 2020

Vehicle Miles Traveled per Jurisdiction, 2020	Vehicle Miles Traveled (VMT)	
	Average Weekday Daily	Average Annual ¹
Arroyo Grande	267,068	92,672,596
Atascadero	501,605	174,056,935
Grover Beach	153,407	53,232,378
Morro Bay	167,302	58,053,794
Paso Robles	559,372	194,102,084
Pismo Beach	498,453	172,963,018
San Luis Obispo	3,298,712	1,144,653,064
Unincorporated County	3,378,180	1,172,228,460
Total	8,824,099	3,061,962,329

¹ Average Annual VMT was calculated by applying a multiplier of 347 to average weekday daily VMT to account for the total number of weekdays in one year based on the recommendation from Caltrans.

The EMFAC2011 model developed by the California Air Resources Board was then used to calculate emissions from the VMT figures above. EMFAC defaults for San Luis Obispo County include regionally-specific information on the mix of vehicle classes and model years, as well as ambient conditions and travel speeds that determine fuel efficiency. Types of emissions accounted for include: running exhaust, idle exhaust, starting exhaust, diurnal, resting loss, running loss, and hot soak. The model estimates carbon dioxide, methane, and nitrous oxide emissions from these factors and inputted vehicle activity data.

WASTE SECTOR

Emissions from the waste sector are an estimate of methane generation from the decomposition of landfilled solid waste in the base year (2005). The methane commitment method embedded in CACP2009 is based on the U.S. Environmental Protection Agency's Waste Reduction Model (WARM) model for calculating life cycle emissions from waste generated within the jurisdictional boundary of the city in 2005. The analysis does not use the waste-in-place method, which calculates emissions from all waste generated in 2005 and all waste already existing in the landfill before the baseline year.

The waste sector only takes into account the waste sent to landfills from city residents, businesses, and institutions. It does not calculate emissions from the total amount of waste sent

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

to county landfills (Paso Robles, Cold Canyon, and Chicago Grade) in 2005 since those landfills accept waste from the unincorporated county and incorporated cities.

Solid waste tonnage data per jurisdiction was provided by:

- “2005 Disposal Report” by quarter, prepared by the San Luis Obispo Integrated Waste Management Board on 3/6/06. Document provided by Peter Cron, San Luis Obispo County Integrated Waste Management Authority (pcron@iwma.com).

Since the composition of waste sent to landfill in 2005 is unknown for the city, the following statewide average waste composition study was utilized:

- CIWMB 2004 Statewide Waste Characterization Study,
<http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097>.

The waste characterization study’s distribution of waste by type was then converted into the five categories included in the CACP2009 software, which resulted in the following waste characterization:

- Paper products: 21.0%
- Food waste: 14.6%
- Plant debris: 6.9%
- Wood/textiles: 21.8%
- All other waste: 35.7%

The CACP2009 software does not have the ability to assign an individual methane recovery factor to each landfill; therefore, we took a weighted average (60%) based on the portion of waste in each landfill. The methane recovery factors of the landfills are well documented by the San Luis Obispo Air Pollution Control District based on the system operations at that time. **Table 7** includes the methane recovery factors for the Chicago Grade and Cold Canyon landfills. Emissions factors were obtain from the LGOP version 1.1.

TABLE 7: COMMUNITY GENERATED WASTE, 2005

Landfill	Methane Recovery	Total Gas Generated (mmcf/yr)	Total Gas Transferred (mmcf/yr)	Data Source	Waste Tonnage from City, 2005 (tons)
Chicago Grade	60%	157.47	94.48	APCD 2005 Inventory	477.78
Cold Canyon	60%	700.00	420.00	APCD 2005 Inventory	19,737.22

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

OFF-ROAD VEHICLES AND EQUIPMENT SECTOR

Off-road emissions were obtained from the California Air Resources Board's OFFROAD2007 model. The model was run using default equipment population, usage, and efficiency data for San Luis Obispo County. Emissions outputs were scaled to the local jurisdiction level by indicators identified in **Table 8**. Results were converted from short tons per day to metric tons per year. Methane and nitrous oxide emissions were converted to carbon dioxide equivalent units based on the Global Warming Potential factors from LGOP version 1.1.

TABLE 8: COUNTY-WIDE EMISSIONS INDICATORS

Equipment Type	Allocation Indicator	Source
Agricultural Equipment	Acres of cropland	San Luis Obispo County, GIS shape files
Construction Vehicles and Equipment	Construction jobs	U.S. Census Bureau, Center for Economic Studies, On the Map Tool
Industrial Equipment	Industrial jobs	U.S. Census Bureau, Center for Economic Studies, On the Map Tool
Lawn and Garden Equipment	Households	Economics Research Associates. (July 2006). SLOCOG Long Range Socio-Economic Projections. 2005 baseline data
Light Commercial Equipment	Service and commercial jobs	U.S. Census Bureau, Center for Economic Studies, On the Map Tool

The OFFROAD2007 software calculates emissions from other sources of off-road equipment as well, including recreational vehicles and watercrafts; however these emissions were not included because there was no feasible methodology for separating these emissions per jurisdiction within the county. Population is proven to not be an accurate indicator of consumption rates. To remain consistent with protocol and practice, emissions must be separated in a spatial manner, similar to how highway emissions are determined by road segment length within each jurisdiction. It should also be noted that many location-sources of off-road emissions, such as recreational vehicle emissions, occur in state parks or beaches outside of the jurisdiction of each city or the county.

APPENDIX C: DETAILED METHODOLOGY FOR COMMUNITY-WIDE INVENTORY

2020 FORECAST

The GHG emissions forecast provides a “business-as-usual estimate,” or scenario, of how emissions will change in the year 2020 if consumption trends and behavior continue as they did in 2005, absent any new federal, state, regional, or local policies or actions that would reduce emissions. The year 2020 was selected for the forecast in order to maintain consistency with AB 32.

The 2020 forecast calculates business-as-usual growth based on population and job growth rates obtained from the San Luis Obispo Council of Governments’ report, “San Luis Obispo County 2040 Population, Housing & Employment Forecast” (August 2011), which takes into account historic and economic changes in population, housing and employment. Mid-range estimates of growth were used (**Figures ES-5 and 6-1**). Specifically population growth rates were applied to residential, waste, off-road, and wastewater sectors; job growth rates were applied to the commercial/industrial sector. For the transportation sector, Fehr & Peers provided VMT estimates for the year 2020 as shown in **Table 6** above.

It should be noted that these forecasts do not take into consideration any planned or actual efficiency or conservation measures after 2005. For example, the State Renewable Energy portfolio has advanced significantly since 2005, but the forecast calculates 2020 energy emissions by assuming constant emissions factors. Reductions occurring since 2005 will be accounted for in an “adjusted business-as-usual forecast” as part of the Climate Action Plan.

APPENDIX D:
DETAILED METHODOLOGY FOR CITY
GOVERNMENT OPERATIONS INVENTORY

APPENDIX D: DETAILED METHODOLOGY FOR GOVERNMENT OPERATIONS INVENTORY

Detailed Methodology for Government Operations GHG Emissions Inventory

The municipal operations inventory follows the LGOP version 1.1, which was adopted in 2010 by CARB and serves as the national standard for quantifying and reporting GHG emissions from local government operations.

BUILDING SECTOR

The building sector includes all emissions from natural gas and electricity consumed in City-owned and - operated buildings and facilities. Pacific Gas and Electric Company (PG&E) and Southern California Gas Company (SoCal Gas Co.) provided municipal electricity and natural gas consumption data respectively. Specifically, data was provided by:

- Jillian Rich, Program Manager with PG&E Green Communities and Innovator Pilots (jillian.rich@pge.com), and John Joseph, PG&E GHG Data Requests
- Paulo Morais, Energy Programs Supervisor with Southern California Gas Company, Customer Programs (pmorais@semprautilities.com)

This raw data was input into the CACP2009 software in kWh and therms. PG&E provided a 2005 carbon dioxide (CO₂) coefficient for electricity use and SoCal Gas Co. provided a carbon dioxide (CO₂) coefficient for natural gas. Emissions coefficients for methane (CH₄) and nitrogen dioxide (N₂O) emissions were provided by the California LGOP version 1.1 and were converted into carbon dioxide equivalents and added to the CO₂ emissions to obtain carbon dioxide equivalent (CO₂e) emissions (see **Appendix C, Tables 3 and 4**).

VEHICLE FLEET SECTOR

The vehicle fleet sector includes gasoline and diesel vehicles from the following City departments:

- Building
- Fire
- Parks
- Police
- Public Works

Gasoline and diesel consumption for calendar year 2007 was obtained from fuel usage billing reports provided by the City Clerk and City Yard. Specific sources of data within each

APPENDIX D: DETAILED METHODOLOGY FOR GOVERNMENT OPERATIONS INVENTORY

organization are outlined in the notes of **Appendix B**. Emissions were calculated using the EMFAC software for the San Luis Obispo region, consistent with the community methodology described in **Appendix C**.

EMPLOYEE COMMUTE SECTOR

Employees were surveyed in September 2009 using an online survey instrument. The questions, attached as **Appendix E**, asked employees about their current commuting patterns. Of those questions, we used the following for our analysis:

- What is your approximate one-way distance to work (in miles)? Please indicate the most direct distance to work, discounting midway destinations that would be taken whether or not you drove to work each day (i.e. dropping off children at school).
- Please indicate the type of transportation you take to work each day in your average work week. Please note that there are two types of carpooling.
 - ◊ Drive alone
 - ◊ Carpool with fellow City employees
 - ◊ Carpool with drivers not employed by the City
 - ◊ Vanpool
 - ◊ Public transit
 - ◊ Motorcycle
 - ◊ Bicycle
 - ◊ Walk
 - ◊ Telecommute
 - ◊ Other
- What type of vehicle do you drive?
- What type of fuel does your vehicle use?
- If you carpool with fellow City employees, how many City employees ride with you? If you carpool with a different number each day, please indicate the average.

Approximately 55 employees responded to the survey with usable information, meaning that all essential questions were answered. Answers with mileage left blank or with highly inconsistent data (example: saying they walked three days to work, biked two, and drove five) were omitted. In addition, if a respondent did not describe their "other" category of transportation, the entry was omitted.

APPENDIX D: DETAILED METHODOLOGY FOR GOVERNMENT OPERATIONS INVENTORY

To perform this analysis, we took the following steps:

- 1) Separate entries by what type of vehicle they own and operate (compact, mid-size car, full-size car, small truck, medium-small truck, large truck, motorcycle or -don't drive"). Within each new group, separate the entries by diesel, gasoline or hybrid.
- 2) For each group of entries with the same vehicle type and technology, multiply the number of miles to work by 2 (to get round-trip estimate) and then by the number of -drive alone" days for each entry. Multiply the number of miles to work by the number of -carpool" days (half of the drive alone emissions). Note: If a respondent entered that they motorcycle to work, but own a car as well, the motorcycle miles were moved to the motorcycle category. Adjust for hybrids (see below).
- 3) Add all miles per vehicle type and technology and multiply by 52.18 work weeks/year.
- 4) Calculate the multiplier to adjust survey response data to the entire 2005 employee population. In 2005, there were 105 employees. This number, divided by the 55 survey entries, gives us our multiplier of 1.909.
- 5) Multiply the mileage per vehicle per technology type by the multiplier.
- 6) Divide the number of hybrid miles by 2.2 and add the difference to the -passenger car" category. This is to account for the large increase in hybrid sales between 2005 and 2009. (Source: Hybridcars.com sales statistics.)
- 7) Manipulate the vehicle classes to fit the CACP2009 software categories.
- 8) Enter final miles into the CACP2009 software per vehicle type and fuel.

**APPENDIX D: DETAILED
METHODOLOGY FOR
GOVERNMENT OPERATIONS
INVENTORY**

TABLE 1: 2009 EMPLOYEE COMMUTE SURVEY

Vehicle Group	2009 Survey Results		Adjusted for 2005	
	Annual VMT	Fuel Type		
Light Trucks	64,311.85	Gasoline	122,771.32	Gasoline
	0	Diesel	0	Diesel
Large Trucks	23,220.10	Gasoline	44,327.17	Gasoline
	0	Diesel	0	Diesel
Passenger Vehicle	242,657.87	Gasoline	34,785.80	Gasoline
	2,348.10	Diesel	4,482.52	Diesel
Total	168,849.26	Gasoline	325,720.04	Gasoline
	2,348.10	Diesel	4,482.52	Diesel

The CACP2009 software does not provide a method of calculating emissions from hybrid cars. As a result, these emissions were divided by 2.20 based on the difference between average fuel economy of a 2005 Toyota Prius and the average fuel economy included in the 2005 San Luis Obispo region EMFAC data and then entered into the CACP2009 software under passenger vehicle (Source: www.fueleconomy.gov).

STREETLIGHT SECTOR

PG&E provided electricity usage from streetlights in kWh for 2005. The total kWh were entered into the CACP2009 software using the electricity coefficients identified in **Appendix C**.

WATER/ SEWAGE SECTOR

This sector calculates emissions from energy consumption associated with City-owned and operated water and wastewater facilities. It does not calculate the total emissions from all water used or treated for the community. Doing so would be including emissions that are accounted for in another jurisdiction, which would cause double-counting. The City is largely not involved with the movement and treatment of water for its residents and businesses, which is why this sector appears insignificant. The City-operated facilities provide for a small part of the collection, treatment, disposal, and movement of water and wastewater within the city. This number does not represent the total emissions from water and wastewater treatment, largely because the City

APPENDIX D: DETAILED METHODOLOGY FOR GOVERNMENT OPERATIONS INVENTORY

relies upon the South SLO County Sanitary District, a Joint Powers Authority (JPA), which manages water treatment for a number of communities.

PG&E and SoCal Gas Co. provided the electricity and natural gas usage associated with water and wastewater facilities as detailed in **Appendix B**. These totals were entered into the CACP2009 software with the electricity and natural gas coefficients presented in **Appendix C**.

WASTE SECTOR

South County Sanitary District reported solid waste tonnage produced by City operations. The City produced 4,160 tons of waste in 2005 that was sent to managed landfills. The waste composition was unknown for the County; therefore, the California averages provided by the 2004 California Integrated Waste Management Board Waste Characterization Report were used. A weighted average methane recovery factor of 60% was used in this analysis, as outlined in **Appendix C**.

OTHER

The other sector includes miscellaneous equipment used by Public Works, Parks and the Fire Department. Equipment included in these sectors is outlined in the detailed CACP2009 report notes in **Appendix B**. There is no automated calculation included in CACP2009 for these sources of emissions; therefore calculations were made outside of CACP2009 and entered into the "other" category.

Data was given in gallons of fuel used per equipment type. Conversion factors of gallons to kg CO₂ and grams N₂O and CH₄ were obtained from Table G.9 and G.12 of the LGOP.

- Small/large utility (gasoline) = 8.81 kg CO₂, 0.22 g N₂O and 0.50 g CH₄ / gallon fuel;
- Other large utility (diesel) = 10.15 kg CO₂, 0.26 g N₂O and 0.58 g CH₄ / gallon fuel.

APPENDIX E:
CITY EMPLOYEE COMMUTE SURVEY, 2009

APPENDIX E: CITY EMPLOYEE COMMUTE SURVEY, 2009

City Employee Commute Survey, 2009

1) What is your approximate one-way distance to work (in miles)? Please indicate the most direct distance to work, discounting midway destinations that would be taken whether or not you drove to work each day (i.e. dropping off children at school).

2) Please indicate the type of transportation you take to work each day in your average work week. Please note that there are two types of carpooling.

	Day 1	Day 2	Day 3	Day 4	Day 5
Drive alone	<input type="checkbox"/>				
Carpool with fellow City employees	<input type="checkbox"/>				
Carpool with other drivers not employed by the City	<input type="checkbox"/>				
Vanpool	<input type="checkbox"/>				
Public transit	<input type="checkbox"/>				
Motorcycle	<input type="checkbox"/>				
Bicycle	<input type="checkbox"/>				
Walk	<input type="checkbox"/>				
Telecommute	<input type="checkbox"/>				
Other	<input type="checkbox"/>				

3) What type of vehicle do you drive?

- Compact/Sub-Compact car (Civic, Corolla, Focus, Neon, Cavalier, Jetta or similar)
- Mid-size car (Accord, Camry, Passat, Monte Carlo, Sable, Sebring or similar)
- Full-size car (Impala, Intrepid, Taurus, Crown Victoria, Bonneville, Town Car or similar)
- Small Truck/SUV/Pickup (RAV4, Chev S10, Pickup (4 cylinder), PT Cruiser or similar)
- Medium-Small Truck/SUV/Pickup (Minivan, Sonoma Pickup Truck or similar)
- Medium-Large Truck/SUV/Pickup (Durango, Safari Cargo Van, Ford F150 or similar)
- Large Truck/SUV/Pickup (Suburban, Expedition, Navigator, Ford E250/350/450 or similar)
- Motorcycle
- I don't drive alone or drive a carpool

APPENDIX E: CITY EMPLOYEE COMMUTE SURVEY, 2009

4) What type of fuel does your vehicle from question 3 use?

- Gasoline
- Diesel
- Biodiesel
- Hybrid
- Electric
- I don't drive to work or drive a carpool
- Other (Specify): _____

5) If you carpool or vanpool with fellow City employees, how many City employees ride with you? If you carpool with a different number each day, please indicate the average. If "not applicable", please enter "-0".

Enter # of people: _____

APPENDIX B

TECHNICAL APPENDIX

GHG Measure Quantification Details

Several factors including GHG reduction potential as well as economic impacts were key factors in evaluating and selecting GHG emissions reduction measures for Arroyo Grande's CAP. This appendix displays pages from the measure evaluation toolbox which detail the methodology, information sources, and assumptions for the GHG reduction potential and cost and savings estimates included in the CAP.

This appendix also contains details regarding the quantification of existing local measures and State reductions which were included in the adjusted forecast as described in Chapter 2 of the CAP.

About the CAP Measure Methods and Calculations

The GHG emission reduction potential of a given measure is quantified following standardized methods for estimating emissions detailed in the California Air Pollution Control Officers Association's (CAPCOA) report Quantifying Greenhouse Gas Mitigation Measures (August 2010). The calculations utilize emissions factors and results from the Arroyo Grande's GHG Emissions Inventory, as well as assumptions made by the City about the degree of implementation in the year 2020.

Costs and savings directly associated with the implementation of each measure were estimated for the City, as well as for residents and businesses, where feasible. Cost estimates generally include initial capital costs (e.g., purchase and installation of technology, program development, etc.) needed to produce the emission reductions estimated by the GHG analysis in 2020, and are based on current (2013) prices. Savings include reduced costs associated with electricity, natural gas, and fuel usage, as well as the reduced need for maintenance, and are also based on current (2013) prices. Costs and savings were estimated using information specific to the region—when available—or for similar cities in the region, State of California, or United States, prioritized in that order. There are numerous factors that will affect the actual costs incurred if the measures are implemented. Because of the uncertainties and variability associated with costs and savings, they are reported as ranges in Chapters 3 and 4 of the CAP.

City Government Energy Efficiency Retrofits and Upgrades

Calculation Methodology and Equations

Key Assumptions for Calculations:

Target percentage of energy savings	20%	Percent
Staff time needed for this measure	0.20	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Municipal Electricity Energy Savings (kWh)= $Em \times P \times 0.95$ Municipal Natural Gas Savings (therms)= $NGm \times P \times 0.05$		
	Where: Em= 1,889,150 Municipal electricity usage (GHG Emissions Inventory) NGm= 9,975 Municipal natural gas usage (GHG Emissions Inventory) P= 20% Target percentage of energy savings (applied 95% electricity, 5% natural gas)		
	358,939 Municipal electricity saved (kWh/year)		
	100 Municipal natural gas saved (therms/year)		
Resource Savings	GHG Savings (MT CO2e)=($Se/1,000 \times 0.133$)+($Sg/10 \times 53.2/1,000$)		
	Where: Se= electricity savings Sg= natural gas savings 1,000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) 10 = conversion factor for therm to MMBtu 0.133 = average projected emissions factor for electricity in 2020 in MT CO2e/MWh 53.20 = average emissions factor for natural gas (kg CO2e/MMBtu)		
GHG Emission Reduction	48 MT CO2e		
Municipal Cost and Savings Calculations	Staff time needed to apply for funding and implement the upgrades. FTE = 0.20 Estimated staff time per year to develop new program \$/FTE= \$100,000 FTE cost Cost of staff time = \$20,000 Dollars		
	Total Savings = kWh reduced/year x \$/kWh + therms reduced/year x \$/therm		
	Where: \$/kWh = \$0.19 California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast \$/Therm = \$0.92 California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		
	Municipal Cost and Savings Municipal Cost = Varies Dollars (costs will vary based on the level of implementation and financial rebates) Municipal Savings = \$68,290 Dollars		

Notes

Actual energy and greenhouse gas emissions savings proposed upgrades. A study of building commissioning found whole-building energy savings of 15% at a cost of \$0.27 per square foot (LBNL). An estimate of LEED for Existing Buildings found the program reduced energy use by 20% (SPUR).

Implementation Resources: PG&E webpage for local governments -
<http://www.pge.com/mybusiness/energysavingsrebates/incentivesbyindustry/government/local/>

References

1. 2005 California End Use Survey <http://www.energy.ca.gov/ceus/>
2. Lawrence Berkeley National Laboratory. 2004. Cost-Effectiveness of Commercial-Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States (page 1). www.ga.wa.gov/eas/bcx/Cx_CostEffectiveness.pdf
3. SPUR - San Francisco Commercial Energy Ordinance http://www.spur.org/publications/library/report/critical_cooling/option4

City Government Energy Efficient Public Realm Lighting

Calculation Methodology and Equations

Key Assumptions for Calculations:

Number of LED street lights installed by 2020	25	Street Lights
Number of LED traffic signals installed by 2020	10	Traffic Signals
Number of LED or CFL other outdoor lights installed by 2020	50	Other Outdoor Lights
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Total electricity saved (kWh) = $(N \times (Wi - We) \times (h/Cf))$				
	Where Street Lights:				
	N_{street} =	25	Number of street lights installed lights		
	Wi =	200	Average estimated power rating in watts of high pressure sodium street light (Department of Energy [DOE] 2004. National Lighting Inventory and Energy Consumption Estimate)		
	We =	50	Average power rating in watts of LED street lighting (DOE and PG&E 2008. LED Street Lighting)		
	h =	4,100	Number of hours per year operating		
	Cf =	1,000	Conversion factor for W to kW		
	Where Traffic Signals:				
	$N_{traffic}$ =	10	Number of traffic installed lights		
	Wi =	150	Average estimated power rating in watts of incandescent traffic signal light. (U.S. Department of Energy, 2004 in Stockton Climate Action Plan).		
	We =	15	Average power rating in watts of LED traffic signal light (CAPCOA 2010)		
	h =	8,760	Number of hours per year operating (24 hours a day)		
	Cf =	1,000	Conversion factor for W to kW		
	Where Other Private Outdoor Lighting (in Public Realm):				
	N_{other} =	50	Number of other outdoor installed lights		
	Wi =	200	Average estimated power rating in watts of public realm lighting (Department of Energy [DOE] 2004. National Lighting Inventory and Energy Consumption Estimate)		
	We =	50	Average power rating in watts of LED public realm lighting (DOE 2004)		
	h =	3,650	Number of hours per year operating		
	Cf =	1,000	Conversion factor for W to kW		
	15,375	Electricity saved from LED street lights (kWh)			
	11,826	Electricity saved from LED traffic signals (kWh)			
	27,375	Electricity saved from LED "other" public realm lighting (kWh)			
	54,576	Total electricity saved (kWh)			
	GHG Savings (MT CO2e)=(Se/1,000 × 0.133)				
GHG Emission Reduction Calculations	Where:				
	Se =	electricity savings			
	1,000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)			
	0.133	= average projected emissions factor for electricity in 2020 in MT CO2e/MWh			
GHG Emission Reduction	7	MT CO2e/year			
GHG Emission Reduction Calculations	Total energy savings = kWh reduced/year * \$/kWh				
	Where:				
	$$/kWh$ =	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		
	Total annual energy cost savings=	\$10,369	Dollars per year		
	Maintenance savings per fixture =	\$17	Annual maintenance savings/fixture (Palo Alto)		
	Some staff time may be needed to implement the program.				
	FTE =	0.05	Estimated staff time per year to develop new program		
	$$/FTE$ =	\$100,000	FTE cost		
	Cost of staff time =	\$5,000	Dollars		

Municipal Costs and Savings Calculations	Total Capital Cost = [Number of units installed x cost per unit] – [Available rebates]		
	Where Streetlights:		
	Number of units installed =	25	Units
	Cost per unit installed =	\$350	Dollars/unit (Energy Solutions 2008; PNNL 2010)
	Total cost =	\$8,750	Dollars
	Available rebates =	\$125	Dollars/unit (\$125 for 200 watt unit replaced - PG&E)
	Net cost =	\$5,625	Dollars (total cost - available rebates)
	Where Traffic Signals:		
	Number of units installed =	10	Units
	Cost per unit installed =	\$193	Dollars/unit (assuming a standard three 12" (red, yellow, and green) balls per signal (Western
	Cost installation =	\$1,930	Dollars
	Available rebates =	\$100	Dollars (\$100 for 150 watt unit replaced - PG&E)
	Net cost =	\$930	Dollars (total cost - available rebates)
Where Other Private Outdoor Lighting (in Public Realm):			
Number of units installed =	50	Units	
Cost per unit installed =	\$300	Dollars/unit (Energy Solutions 2008; PNNL 2010)	
Cost installation =	\$15,000	Dollars	
Available rebates =	\$100	Dollars (\$100 for 150 watt unit replaced - PG&E)	
Net cost =	\$10,000	Dollars (total cost - available rebates)	
Municipal Cost =	\$21,555	Dollars	
Municipal Savings =	\$10,854	Dollars	

Notes

Lamp wattage varies. Stationary source outdoor lights range from 83W to 407 W (DOE, page 48). LED lamps are typically under 100 W (DOE and PG&E).

References

1. PG&E Streetlight program -
<http://www.pge.com/mybusiness/energysavingsrebates/rebatesincentives/ref/lighting/lightemittingdiodes/streetlightprogram.shtml>
2. DOE National Lighting Inventory and Energy Consumption Estimate
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/lmc_vol1_final.pdf
3. DOE and PG&E LED Street Lighting study - http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_sf-streetlighting.pdf
4. PG&E LED Streetlight Rebates -
<http://www.pge.com/mybusiness/energysavingsrebates/rebatesincentives/ref/lighting/lightemittingdiodes/incentives/index.shtml>
5. Western Pacific Signal 2011; eLightBulbs 2011; Energy Solutions 2008; PNNL 2010 from Stockton Draft CAP -
<http://www.stocktongov.com/files/ClimateActionPlanDraftFeb2012.pdf>
6. Palo Alto - Demonstration Assessment of Light-Emitting Diode (LED) Roadway Lighting on Residential and Commercial Streets -
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_palo-alto.pdf

Energy Efficiency Requirements for New City-owned Buildings

Calculation Methodology and Equations

Key Assumptions for Calculations:

New municipal building square feet by 2020	25,000	Square Feet
Target percentage of energy savings above State standards	20%	Percent
Staff time needed for this measure	0.08	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Municipal Electricity Energy Savings (kWh)= $E \times Eec \times (1 - CSP) \times 12.95 \times Msf$ Municipal Natural Gas Savings (therms)= $E \times Egc \times (1 - CSP) \times 0.29 \times Msf$				
	Where:				
	Msf=	25,000	New municipal building square feet by 2020		
	E=	20%	Target percentage of energy savings		
	Eec=	64%	Percent of commercial electricity use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)		
	Egc=	70%	Percent of commercial natural gas use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)		
	CSP=	30%	Percent non-residential energy savings above current State standards (CEC 2013 Building Efficiency Standards, slide 17)		
	Municipal electricity use intensity=	12.954999	kWh/square foot/year (Average electric use intensity for commercial buildings in kWh/square feet/year (California Energy Commission [CEC] 2005 California End Use Survey [CEUS], page 8))		
Resource Savings	Municipal natural gas use intensity=	0.34999	therms/square foot/year (Average natural gas usage intensity for commercial buildings in therms/square feet/year (CEC 2005 CEUS, page 8))		
	29,019	Municipal kWh/year saved			
	857	Municipal therms/year saved			
GHG Emission Reduction Calculations	GHG Savings (MT CO2e) = $(Se/1,000 \times 0.133) + (Sg/10 \times 53.2/1,000)$				
	Where:				
	Se=	electricity savings			
	Sg=	natural gas savings			
	1000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)			
	10	= conversion factor for therm to MMBtu			
	0.133	= average projected emissions factor for electricity in 2020 in MT CO2e/MWh			
GHG Emission Reduction	53.20	= average emissions factor for natural gas (kg CO2e/MMBtu)			
	8	MT CO2e			
Municipal Costs and Savings	Staff time developing policy Municipal cost savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms]				
	Commercial \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		
	Commercial \$/therm=	\$0.81	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		
	FTE =	0.08	Estimated staff time per year to develop new program		

Municipal Costs and Savings	\$/FTE =	\$100,000	FTE cost
	Total cost off staff time =	\$8,000	Dollars
	Cost of implementation =	\$1.25	Average cost to implement (sq ft) - Projected PG&E Zone 5 Costs (CA Department of Energy)
	Total implementation cost =	\$31,250	Dollars
Municipal Cost and Savings	Municipal Cost =	\$39,250	Dollars
	Municipal Savings =	\$6,092	Dollars

Notes

Title 24 covers only 64% of commercial electricity use and 70% of natural gas use (SEEC, page 7). 2013 Title 24 updates are expected to reduce non-residential energy use by 30% (CEC).

References

1. 2005 California End Use Survey <http://www.energy.ca.gov/ceus/>
2. CEC 2013 Building Efficiency Standards, slide 17 - http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2012-05-31_2013_standards_adoption_hearing_presentation.pdf
3. SEEC 2011 Greenhouse Gas Forecasting Assistant, page 7 - <http://californiaseec.org/documents/forecasting-tools/seec-forecast-assistant-documentation>
4. http://www.energy.ca.gov/title24/2008standards/ordinances/san_luis_obispo/CZ5_Cost-Effectiveness_Report-Final.pdf

Zero and Low Emission City Fleet Vehicles

Calculation Methodology and Equations

Key Assumptions for Calculations:

Number of municipal vehicles replaced by 2020	10	Vehicles
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Fuel savings (gallons) = $V \times M (1/Fi - 1/Fe)$		
	Where:		
	Number of vehicles replaced (V) =	10	Vehicles
	Average miles driven per year (M) =	7,500	Miles per year
	Average fuel economy of replaced vehicles (Fi) =	25	Miles per gallon
GHG Emission Reduction Calculations	Average fuel economy of newer (more efficient) vehicles (Fe) =	50	Miles per gallon
	Resource Savings	Fuel Savings =	1,500
	GHG reduced (MT CO2e) = Fuel savings (gallons gasoline) x 8.81 / 1,000		
GHG Emission Reduction	8.81	= GHG emission from gasoline (kg CO2/gallon)	
	1,000	= Conversion from kg to metric tons	
Municipal Costs and Savings	Total GHG Savings	13	MT CO2e
Municipal Costs and Savings	Energy cost per mile of regular gasoline vehicle =	\$0.1468	Dollars per mile (standard car. Ex, Toyota Corolla) (RechargeIT)
	Energy cost per mile of hybrid vehicle =	\$0.0690	Dollars per mile (Electric vehicles. Ex, Toyota Prius Plug-in Hybrid, RechargeIT)
	Difference in energy cost per mile =	\$0.0778	Dollars per mile
	Estimate average miles driven per year =	7,500	Miles per year
	Difference in purchase price for hybrid above similar non-hybrid vehicle =	\$4,315	Dollars (US DOE)
Municipal Costs and Savings	Municipal Costs =	\$43,150	Dollars (Assumes no staff time needed above that required for purchasing regular gasoline vehicles.)
	Municipal Savings =	\$1,751	Dollars

Notes

See RICAPS, Strategy TM4.

References

1. RechargeIT Driving Experiment: Demonstration of energy efficiency for electric vehicles. Google, org, 2007.

<http://www.google.org/recharge/>

2. US Department of Energy (DOE)- fueleconomy.gov

City Government Solid Waste Reduction

Calculation Methodology and Equations

Key Assumptions for Example Calculations:

Target diversion rate (2020)	15%	Percent
Number of new recycling receptacles	15	Recycling Receptacles
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Tons Diverted = Landfilled Tonnage x Targeted Diversion Rate		
	Total City Future Year (2020) Solid Waste Tonnage =	23	Tons
	Paper Products =	21.0%	Percent
	Food Waste =	14.6%	Percent
	Plant Debris =	6.9%	Percent
	Wood/Textiles =	21.8%	Percent
	All Other Waste =	35.7%	Percent
	Future Year Paper Products =	5	Tons
	Future Year Food Waste =	3	Tons
	Future Year Plant Debris =	2	Tons
	Future Year Wood/Textiles =	5	Tons
	Future Year All Other Waste =	8	Tons
	Paper Products Diverted =	0.7	Tons
	Food Waste Diverted =	0.5	Tons
	Plant Debris Diverted =	0.2	Tons
	Wood/Textiles Diverted =	0.8	Tons
	All Other Waste Diverted =	1.2	Tons
Resource Savings	Future Year Total Waste Diverted =	3.5	Tons
	Total MT CO2e Diverted = (2.138)(Paper Products)(0.9072) + (1.120)(Food Waste)(0.9072) + (0.686)(Plant Debris)(0.9072) + (0.605)(Wood/Textiles)(0.9072) + (0.00)(All Other Waste)(0.9072)		
	1 - Emission Reduction Per Waste Category = Emissions Factor for Category x Future Year Category Tonnage Diverted x 0.9072 x (1 - Emissions captured at landfill)		
	0.9072	= Conversion from tons to metric tons	
	Emission Factor - Paper Products	2.138	MT CO2e / MT waste
	Emission Factor - Food Waste	1.210	MT CO2e / MT waste

GHG Emission Reduction Calculations	Emissions Factor - Plant Debris	0.686	MT CO2e / MT waste
	Emission Factor - Wood/Textiles	0.605	MT CO2e / MT waste
	Emission Factor - All Other Waste	0.000	MT CO2e / MT waste
	Emissions from Paper Products =	1	Metric Tons CO2e
	Emissions from Food Waste =	1	Metric Tons CO2e
	Emissions from Plant Debris =	0	Metric Tons CO2e
	Emissions from Wood/Textiles =	0	Metric Tons CO2e
	Emissions from All Other Waste =	0	Metric Tons CO2e
	Emissions captured at landfill =	60%	Percent
GHG Emission Reduction	Total GHG Emissions Reductions =	1	Metric Tons CO2e
Municipal Costs and Savings Calculations	Cost may include additional staff time.		
	FTE =	0.1	Estimated staff time per year
	\$/FTE =	\$100,000	FTE cost per year
	Total staff time costs =	\$5,000	Dollars
	Capital cost to City =	\$7,500	Dollars (Assumes average cost of commercial recycling receptacle is \$500.)
	Maintenance cost to City =	\$300	Dollars
Municipal Costs and Savings	Municipal Costs=	\$12,800	Dollars
	Municipal Savings=	\$0	Dollars

Notes

All cities are assumed to have a baseline year diversion rate of 50%. This diversion has already been accounted for in the baseline year landfilled solid waste tonnage.

CAGR growth rates were calculated based on population growth.

GHG Emissions Calculations assume a landfill methane recovery rate of 60%.

ICLEI's CACP software incorporates emission factors for the diversion of certain materials from the waste stream, derived from the EPA WARM model.

Assumes average cost of a commercial recycling receptacle to be \$500 and ongoing additional maintenance to be \$20 per receptacle.

References

1. DRAFT City of Stockton Climate Action Plan (February 2012) - pg. C-77,C-78
2. Hayward Climate Action Plan (October, 2009) - pg. 170
3. County of San Bernardino Greenhouse Gas Emissions Reduction Plan (September 2011) - pg. 91
4. EPA's Waste Reduction Model (WARM), available at: http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html
5. ICLEI's Clean Air Climate Protection (CACP) Software (for members), available at: <http://www.icleiusa.org/action-center/tools/cacp-software>

City Government Tree Planting Program

Calculation Methodology and Equations

Note: There is no reduction in GHG emissions associated with preservation of existing trees or mitigation of trees removed.

Key Assumptions for Calculations:

Target number of trees planted on City-owned property	250	Trees
Capital cost per tree (\$0 if to be paid for through grant funding)	\$60	Dollars per Tree
Staff time needed for this measure	0.02	Full Time Equivalent (FTE)

Calculations:

GHG Emission Reduction Calculations	GHG Emissions Reductions = Number of Trees Planted x Carbon Sequestration Rate		
	0.0121	= Average carbon sequestration (MT CO ₂ /Tree)	
	250	= Number of Trees Planted	
GHG Emission Reduction	Annual GHG emissions reduced =	3	MT CO ₂ e
Capital cost = (cost per tree x number of trees planted)			
Where:			
Cost per tree = \$60 Dollars/tree (McPherson, et al)			
Number of trees planted = 250 Trees/year			
Capital cost to City = \$15,000 Dollars			
Municipal Costs and Savings Calculations			
Maintenance cost = maintenance cost per tree x number of trees planted			
Where:			
Maintenance cost = \$34 Dollars/tree (McPherson, et al)			
Maintenance costs = \$8,500 Dollars			
Staff time needed to develop policy/ordinance and apply for funding.			
FTE = 0.02 Estimated staff time per year			
\$/FTE = \$100,000 FTE cost per year			
Staff time cost = \$2,000 Dollars			
Municipal Costs and Savings			
Municipal Cost = \$25,500 Dollars			
Municipal Savings = \$0 Dollars			

Notes

Carbon sequestration rate from CAPCOA Quantifying GHG Mitigation Measures Report. There is no reduction in GHG emissions associated with preservation of existing trees or mitigation of trees removed. Account for net new trees only.

References

1. California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures (August 2010) - pg. 403
2. McPherson, et al as cited in Stockton Draft CAP - <http://www.stocktongov.com/government/boardcom/clim.html>

Energy Efficiency Outreach and Incentive Programs

Calculation Methodology and Equations

Key Assumptions for Calculations:

Percent of households participating by 2020	25%	Percent
Percent of businesses participating by 2020	30%	Percent
Targeted percent residential energy savings	5%	Percent
Targeted percent commercial energy savings	6%	Percent
Staff time needed for this measure	0.03	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	$\text{Residential Electricity Savings (kWh)} = Rp \times Rs \times 95\% \times Re$ $\text{Residential Natural Gas Savings (therms)} = Rp \times Rs \times 5\% \times Rn$ $\text{Commercial Electricity Savings (kWh)} = Cp \times Cs \times 95\% \times Ce$ $\text{Commercial Natural Gas Savings (kWh)} = Cp \times Cs \times 5\% \times Cn$				
	Where:				
	Rp=	25%	Percent of residences participating in rebate and programs by 2020		
	Cp=	30%	Percent of businesses participating in rebate and incentive programs by 2020		
	Rs=	5%	Percent residential energy savings (applied 95% electricity, 5% natural gas)		
	Cs=	6%	Percent commercial energy savings (applied 95% electricity, 5% natural gas)		
	Re=	43,875,166	2020 residential electricity usage (kWh)		
	Rn=	3,401,593	2020 residential natural gas usage (therms)		
	Ce=	25,343,608	2020 commercial electricity use (kWh)		
Resource Savings	Cn=	574,771	2020 commercial natural gas usage (therms)		
	521,018	Residential electricity saved (kWh)			
	2,126	Residential natural gas saved (therms)			
	433,376	Commercial electricity saved (kWh)			
GHG Emission Reduction Calculations	517	Commercial natural gas saved (therms)			
	$\text{GHG Savings (MT CO}_2\text{e)} = (Se/1,000 \times 0.133) + (Sg/10 \times 53.2/1,000)$				
	Where:				
	Se=	Residential or commercial electricity savings			
	Sg=	Residential or commercial natural gas savings			
	1,000	= Conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)			
	10	= Conversion factor for therm to MMBtu			
GHG Emission Reduction	0.133	= Average projected emissions factor for electricity in 2020 in MT CO ₂ e/MWh			
	53.20	= Average emissions factor for natural gas (kg CO ₂ e/MMBtu)			
	81	Residential Reduction (MT CO ₂ e)			
Municipal Costs and Savings Calculations	60	Commercial Reduction (MT CO ₂ e)			
	141	Total Reduction (MT CO ₂ e) in 2020			
	Staff time to participate in and promote existing programs.				
Municipal Costs and Savings	FTE =	0.03	Estimated staff time per year		
	\$/FTE=	\$100,000	FTE cost per year		
Municipal Costs and Savings	Municipal Cost =	\$2,500	Dollars		
	Municipal Savings =	\$0	Dollars		

Community Costs and Savings Calculations	Total savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms]		
	Where:		
	Residential \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Residential \$/therm=	\$0.92	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Commercial \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Commercial \$/therm=	\$0.81	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Total residential savings=	\$100,949	Dollars per year
	Total commercial savings=	\$81,027	Dollars per year
	Households =	8,188	Total number of households projected in 2020
	Households participating =	2,047	Households participating by 2020
	Commercial units =	1,441	Total number of projected commercial units in 2020
	Commercial units participating =	432	Commercial units participating by 2020
Community Cost and Savings	Residential Cost =	None	Dollars per household (no mandatory costs; voluntary costs vary based on degree of implementation)
	Commercial Cost =	None	Dollars per business (no mandatory costs; voluntary costs vary based on degree of implementation)
	Residential Savings =	\$49	Dollars per household
	Commercial Savings =	\$187	Dollars per business

Notes

Assumes that of the total percent reduction in energy use, 95% applies to electricity and 5% applies to natural gas.

References

1. Pacific Gas and Electricity Company. 2012. Energy Overview Tableau Reports.
2. Rincon Consultants. November 2012. Cities Greenhouse Gas Emissions Inventories.
3. California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast

Energy Audit and Retrofit Program

Calculation Methodology and Equations

Key Assumptions for Calculations:

Number of households audited by 2020	250	Units
Number of businesses audited by 2020	100	Units
Target percentage of energy savings	15%	Percent
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	$\text{Residential Square Feet (Rsf)} = \text{Ru} \times 1,545$ $\text{Residential Electricity Energy Savings (kWh)} = \text{E} \times 0.40 \times \text{Rsf} \times 3.5$ $\text{Residential Natural Gas Savings (therms)} = \text{E} \times 0.40 \times \text{Rsf} \times 0.3$		
	Ru=	250	# residential units audited by 2020
	Average residential unit size=	1,545	Square feet/dwelling unit (California Energy Commission [CEC] 2010 Residential Appliance Saturation Survey [RASS])
	Audit to retrofit conversion rate=	40%	Percentage of units that receive an audit that complete energy efficiency installation (Energy Savvy)
	Rsf=	154,500	# square feet of residential space retrofitted by 2020
	E=	15%	Target percentage of energy savings
	Residential electricity use intensity=	3.5	kWh/square foot/year (Average electric use intensity for residential buildings in kWh/square foot/year [RASS]).
	Residential natural gas use intensity=	0.3	Therms/square foot/year (Average natural gas usage intensity for residential buildings in therms/square foot/year [RASS]).
	$\text{Commercial Square Feet (Csf)} = \text{Cu} \times 4,500$ $\text{Commercial Electricity Energy Savings (kWh)} = \text{E} \times 0.40 \times \text{Csf} \times 12.95$ $\text{Commercial Natural Gas Savings (therms)} = \text{E} \times 0.40 \times \text{Csf} \times 0.3$		
	Where:		
Resource Savings	Cu=	100	# of commercial units or buildings audited by 2020
	Average commercial unit size=	4,500	Average commercial unit/business size in square feet
	Audit to retrofit conversion rate=	40%	Percentage of units that receive an audit that complete energy efficiency installation (Energy Savvy)
	Csf=	180,000	Square feet of commercial space upgraded by 2020
	E=	15%	Target percentage of energy savings
	Commercial electricity use intensity=	12.95	kWh/square foot/year (Average electric use intensity for commercial buildings in kWh/square foot/year (California Energy Commission [CEC] 2005 California End Use Survey [CEUS], page 184)).
	Commercial natural gas use intensity=	0.3	therms/square foot/year (Average natural gas usage intensity for commercial buildings in therms/square foot/year (CEC 2005 CEUS, page 184)).
	82,269	Residential electricity saved (kWh)	
	8,109	Residential natural gas saved (therms)	
	349,785	Commercial electricity saved (kWh)	
	9,450	Commercial natural gas saved (therms)	
	$\text{GHG Savings (MT CO}_2\text{e)} = (\text{Se}/1,000 \times 0.133) + (\text{Sg}/10 \times 53.20/1,000)$		

	Where:					
	Se=	electricity savings				
	Sg=	natural gas savings				
	1,000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)				
	10	= conversion factor for therm to MMBtu				
	0.133	= average projected 2020 electricity emissions factor (MT CO2e/MWh)				
	53.20	= average emissions factor for natural gas (kg CO2e/MMBtu)				
GHG Emission Reduction Calculations	54	Residential Reduction (MT CO2e) in 2020				
	97	Commercial Reduction (MT CO2e) in 2020				
Municipal Cost and Savings Calculations	Staff time developing and administering program.					
	FTE =	0.05	Staff time needed for this measure			
	\$/FTE=	\$100,000	Cost associated with staff time			
Municipal Cost and Savings	Municipal Cost=	\$5,000	Dollars			
	Municipal Savings =	\$0	Dollars			
Community Costs and Savings Calculations	Total savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms]					
	Where:					
	Residential \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast			
	Residential \$/therm=	\$0.92	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast			
	Commercial \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast			
	Commercial \$/therm=	\$0.81	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast			
	\$23,091	Residential Savings (\$/year)				
	\$72,714	Commercial Savings (\$/year)				
	Total Cost of residential retrofit =	\$3,000	Cost per home (average ACEEE)			
	Available residential rebates =	\$1,500	Energy Upgrade California offers rebates ranging from \$2,000-\$4,000 (\$2,500 rebate for 25% energy savings).			
	Total cost of commercial retrofit =	\$4,545	Cost per commercial unit (\$1.01 per square foot - AECOM 2010; Gregerson 1997)			
	Available commercial rebates =	\$2,273	PG&E offers \$0.09/kWh (PG&E Customized Retrofit Incentives) and SCE offers \$1.00/therm (SCE Financial Incentives for Energy Efficiency) for retrofit projects, with the total incentive capped at 50% of the measure cost			
	Residential Cost =	\$1,500	Dollars per household			
	Commercial Cost =	\$2,273	Dollars per business			
	Residential Savings =	\$92	Dollars per household			
	Commercial Savings =	\$727	Dollars per business			

Notes

This is based on average energy consumption. Programs that emphasize audits and retrofits to buildings constructed prior to Title 24 (1980), will see greater reductions.

Audit to retrofit conversion rates and energy savings vary significantly by program. In a study of 16 audit programs around the country, audit to retrofit conversion rates ranged from 30% to 50% (Energy Savvy). In a study of 7 residential audit programs between 2000 and 2004 in California, expected savings ranged from 50 kWh per audit to 800 kWh per audit (NEEBPG). This represents between 1% and 15% of energy use (NEEBPG).

When combining energy measures, the City should be aware of double-counting emission reductions. Some actions in this measure overlap with actions in Measures 3a and 3d, and this overlay diminishes the overall effectiveness of the measure and its actions. If the City selects both measures, it should lower the commitment established in terms of units or percent reduction in order to address the issue of double-counting.

References

1. Energy Savvy - Energy Audit Programs That Work <http://www.energysavvy.com/blog/2010/09/14/energy-audit-programs-that-work/>
2. NEEBPG - Residential Audit Programs Best Practices Report http://www.eebestpractices.com/pdf/BP_R7.PDF
3. California Energy Commission [CEC] 2010 Residential Appliance Saturation Survey [RASS] - <http://www.energy.ca.gov/appliances/rass/>
4. PG&E Energy House Calls - http://www.energyhousecalls.com/?WT.mc_id=GSEHC154&WT.srch=1&gclid=CJ6xi8_jmLMCFQSqnQodsAEAiA
5. Energy Upgrade California - <http://www.pge.com/myhome/saveenergymoney/energysavingprograms/euca.shtml>
6. Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey - http://www.eia.gov/emeu/consumptionbriefs/cbecs/pbawebpage/retailserv_retserv_lowlarge.htm
7. CONSOL. August 2008. Meeting AB 32 -- Cost-Effective Green House Gas Reductions in the Residential Sector, available at: <http://www.cbia.org/go/cbia/?LinkServID=D3BFD657-F8E2-4F63-97B404B55FD856B5&showMeta=0>
8. PG&E Third Party Screen and Certification of Home Improvement Contractors - <http://www.egia.org/Academy/rockymountainexchange2011/docs/JaneKruse.pdf>
9. PG&E Customized Retrofit Incentives - <http://www.pge.com/mybusiness/energysavingsrebates/rebatesincentives/ief/>
10. SCE Financial Incentives for Energy Efficiency - <http://www.socalgas.com/documents/business/EECIPFactSheet.pdf>
11. U.S. Department of Energy (DOE). 2011a. Home Energy Saver. Available: <<http://hes.lbl.gov/consumer>>. Accessed: July 6, 2011.
12. American Council for an Energy-Efficient Economy (ACEEE), Berkeley RECO Case Study - <http://aceee.org/sector/local-policy/case-studies/berkeley-california-residential-energ>

Income-Qualified Energy Efficient Weatherization Programs

Calculation Methodology and Equations

Key Assumptions for Calculations:

Residential units upgraded by 2020	100	Units
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Residential Square Feet (Rsf) = $Ru \times 1,545$ Residential Electricity Energy Savings (kWh)= $E \times Rsf \times 3.5$ Residential Natural Gas Savings (therms)= $E \times Rsf \times 0.3$				
	Ru=	100	Residential units upgraded by 2020		
	Average residential unit size=	1,545	Square feet/dwelling unit California Energy Commission [CEC] 2010 Residential Appliance Saturation Survey [RASS])		
	Rsf=	154,500	Square feet of residential space upgraded by 2020		
	E=	35%	Average first-year weatherization energy savings (Oak Ridge National Laboratory (ORNL) 2010 Weatherization Assistance Program Technical Memorandum: Background Data and Statistics. Page 5.)		
	Residential electricity use intensity=	3.5499	kWh/square foot/year (Average electric use intensity for residential buildings in kWh/square foot/year [RASS]).		
Resource Savings	Residential natural gas use intensity=	0.3	Therms/square foot/year (Average natural gas usage intensity for residential buildings in therms/square foot/year [RASS]).		
	191,961	Residential electricity saved (kWh)			
GHG Emission Reduction Calculations	18,921	Residential natural gas saved (therms)			
	GHG Savings (MT CO2e)=(Se/1,000 × 0.133)+(Sg/10 × 53.2/1,000)				
	Where:				
	Se=	electricity savings			
	Sg=	natural gas savings			
	1,000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)			
	10	= conversion factor for therm to MMBtu			
GHG Emission Reduction	0.133	= average projected emissions factor for electricity in 2020 in MT CO2e/MWh			
	53.20	= average emissions factor for natural gas (kg CO2e/MMBtu)			
126	MT CO2e				
Municipal Costs and Savings Calculations	Staff time coordinating with CAPSLO and local utilities, and conducting outreach.				
	FTE =	0.05	Staff time needed for this measures		
	\$/FTE=	\$100,000	Dollars per year		
Municipal Costs and Savings	Municipal Cost=	\$5,000	Dollars		
	Municipal Savings =	\$0	Dollars		
Community Costs and Savings Calculations	Residential cost savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms]				
	Where:				
	Residential \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		
	Residential \$/therm=	\$0.92	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		
	Total Community Savings =	\$53,880	Residential Savings		
Community Cost and Savings	Community Cost =	\$0	Dollars per household		

Community Cost and Savings	Community Savings =	\$539	Dollars per household
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Notes

The first-year energy savings for LIHEAP households is approximately 34.5% or \$437 (ORNL). The average energy savings per low-income housing unit for Weatherization Assistance is estimated by the State of California Department of Community Services and Development (CSD) to be \$418 per year.

When combining energy measures, the City should be aware of double-counting emission reductions. Some actions in this measure overlap with actions in Measures 3a and 3d, and this overlay diminishes the overall effectiveness of the measure and its actions. If the City selects both measures, it should lower the commitment established in terms of units or percent reduction in order to address the issue of double-counting.

PG&E and SoCalGas contract with CAPSLO to provide weatherization services to the region as part of the statewide Energy Savings Assistance Program (ESAP). <http://www.cpuc.ca.gov/PUC/energy/Low+Income/liee.htm>

For low-income households: no-cost weatherization under Energy Savings Assistance Program. For middle-income households: free weatherization under PG&E's Middle Income Direct Install program.

References

1. CSD - Helps Low-Income Families Manage and Reduce Energy Costs <http://www.csd.ca.gov/Contractors/documents/Energy%20tab/LIHEAP-DOE%20Fact%20Sheet%20%282008%29.pdf>
2. California Energy Commission [CEC] 2010 Residential Appliance Saturation Survey [RASS] - <http://www.energy.ca.gov/appliances/rass/>
3. ORNL 2010 Weatherization Assistance Program Technical Memorandum: Background Data and Statistics (page 5) - http://weatherization.ornl.gov/pdfs/ORNL_TM-2010-66.pdf
4. California Energy Commission (CEC) 2005 California End Use Survey - <http://www.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF>
5. California Flex Your Power - <http://www.fypower.org/feature/lowincome/>
6. PG&E Direct Install -<http://www.staplesenergy.com/residential-case-studies/pge-middle-income-direct-install-program>

Energy Conservation Ordinance

Calculation Methodology and Equations

Key Assumptions for Calculations:

Number of residential units retrofitted by 2020	700	Units
Number of non-residential buildings retrofitted by 2020	100	Units
Target percentage of energy savings	15%	Percent
Staff time needed for this measure	0.15	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	$\text{Residential Square Feet (Rsf)} = \text{Ru} \times 1,545$ $\text{Residential Electricity Energy Savings (kWh)} = \text{E} \times \text{Rsf} \times 3.5$ $\text{Residential Natural Gas Savings (therms)} = \text{E} \times \text{Rsf} \times 0.3$			
	$\text{Ru} =$	700	# residential units affected by ordinance by 2020	
	Average residential unit size =	1,545	Square feet/dwelling unit (California Energy Commission [CEC] 2010 Residential Appliance Saturation Survey [RASS])	
	$\text{Rsf} =$	1,081,500	# square feet of residential space retrofitted by 2020	
	$\text{E} =$	15%	Target percentage of energy savings	
	Residential electricity use intensity =	3.5	kWh/square foot/year (Average electric use intensity for residential buildings in kWh/square foot/year [RASS]).	
	Residential natural gas use intensity =	0.3	Therms/square foot/year (Average natural gas usage intensity for residential buildings in therms/square foot/year	
	$\text{Commercial Square Feet (Csf)} = \text{Cu} \times 4,500$ $\text{Commercial Electricity Energy Savings (kWh)} = \text{E} \times \text{Csf} \times 12.95$ $\text{Commercial Natural Gas Savings (therms)} = \text{E} \times \text{Csf} \times 0.3$			
	Where:			
	$\text{Cu} =$	100	# of commercial units or buildings audited by 2020	
Resource Savings	Average commercial unit size =	4,500	Average square feet for all commercial buildings	
	$\text{Csf} =$	450,000	Square feet of commercial space upgraded by 2020	
	$\text{E} =$	15%	Target percentage of energy savings	
	Commercial electricity use intensity =	12.95	kWh/square foot/year (Average electric use intensity for commercial buildings in kWh/square feet/year [California Energy Commission [CEC] 2005 California End Use Survey	
	Commercial natural gas use intensity =	0.3	therms/square foot/year (Average natural gas usage intensity for commercial buildings in therms/square	
GHG Emission Reduction Calculations	575,883	Residential electricity saved (kWh)		
	56,763	Residential natural gas saved (therms)		
	874,462	Commercial electricity saved (kWh)		
	23,624	Commercial natural gas saved (therms)		
	$\text{GHG Savings (MT CO}_2\text{e)} = (\text{Se}/1,000 \times 0.133) + (\text{Sg}/10 \times 53.20/1,000)$			
GHG Emission Reduction	Where:			
	$\text{Se} =$	electricity savings		
	$\text{Sg} =$	natural gas savings		
	1,000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)		
	10	= conversion factor for therm to MMBtu		
	0.133	= average projected 2020 electricity emissions factor (MT CO2e/MWh)		
	53.20	= average emissions factor for natural gas (kg CO2e/MMBtu)		
Municipal Cost and Savings Calculations	379	Residential Reduction (MT CO2e) in 2020		
	242	Commercial Reduction (MT CO2e) in 2020		
Municipal Cost and Savings	Staff time developing and administering program.			
	FTE =	0.15	Staff time needed for this measure	
	$\$/\text{FTE} =$	\$100,000	Cost associated with staff time	
	Municipal Cost =	\$15,000	Dollars	
	Municipal Savings =	\$0	Dollars	
	Total Savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms]			
	Where:			

Community Costs and Savings Calculations	Residential \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Residential \$/therm=	\$0.92	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Commercial \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Commercial \$/therm=	\$0.81	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	\$161,639	Total Residential Savings (\$/year)	
	\$181,786	Total Commercial Savings (\$/year)	
	Total cost of residential upgrades =	\$3,000	Cost per home can ranges from approximately \$800 to 1% of sale price (ACEEE)
	Available residential rebates =	\$1,500	Energy Upgrade California offers rebates ranging from \$2,000-\$4,000 (% energy savings*1,000)
	Total cost of commercial upgrades =	\$4,545	Cost per commercial unit (average \$1.01 per square foot - from LBNL in SPUR)
	Available commercial rebates =	\$2,273	PG&E offers \$0.09/kWh (PG&E Customized Retrofit Incentives) and SCE offers \$1.00/therm (SCE Financial Incentives for Energy Efficiency) for retrofit projects, with
Community Costs and Savings	Residential Cost =	\$1,500	Dollars per household
	Commercial Cost =	\$2,273	Dollars per business
	Residential Savings =	\$231	Dollars per household
	Commercial Savings =	\$1,818	Dollars per business

Notes

Energy savings depends on the stringency of requirements. San Francisco estimates a 15% reduction in energy use as a result of their RECO (Eco Leader). Similarly, an evaluation of RECO ordinance options in Boulder found a range of 10%-20% reductions in energy use (Boulder).

When combining energy measures, the City should be aware of double-counting emission reductions. Some actions in this measure overlap with actions in Measures 3a and 3b, and this overlay diminishes the overall effectiveness of the measure and its actions. If the City selects both measures, it should lower the commitment established in terms of units or percent reduction in order to address the issue of double-counting.

References

1. California Energy Commission [CEC] 2010 Residential Appliance Saturation Survey [RASS] - <http://www.energy.ca.gov/appliances/rass/>
2. Eco Leader - Residential Energy Conservation Ordinance Factsheet http://ecoleader.org/assets/downloads/RECO/RECO_factsheet.pdf
3. City of Boulder RECO Report (page 4) -http://www.bouldercolorado.gov/files/reco_report_boulder.pdf.
4. American Council for an Energy-Efficient Economy (ACEEE), Berkeley RECO Case Study - <http://aceee.org/sector/local-policy/case-studies/berkeley-california-residential-energ>
5. SPUR - Reinstate the Commercial Energy Conservation Ordinance (CECO) -
http://www.spur.org/publications/library/report/critical_cooling/option4
http://www.spur.org/publications/library/report/critical_cooling/option3

Incentives for Exceeding Title 24 Building Energy Efficiency Standards

Calculation Methodology and Equations

Key Assumptions for Calculations:

New or remodeled residences exceeding State standards	100	Units
New non-residential buildings exceeding State standards	50	Units
Target percentage of energy savings above State standards	20%	Percent
Staff time needed for this measure	0.03	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	$\text{Residential Square Feet (Rsf)} = \text{Ru} \times 1,545$ $\text{Residential Electricity Energy Savings (kWh)} = \text{E} \times \text{Eec} \times \text{Rsf} \times (1 - \text{CSP}) \times 3.5$ $\text{Residential Natural Gas Savings (therms)} = \text{E} \times \text{Egc} \times \text{Rsf} \times (1 - \text{CSP}) \times 0.3$																				
	Ru=	100	# of new residential units exceeding State standards by 2020																		
	Average residential unit size=	1,545	Square feet/dwelling unit (California Energy Commission [CEC] 2010 Residential Appliance Saturation Survey (RASS))																		
	Rsf=	154,500	# square feet of residential space that exceed State standards by 2020																		
	E=	20%	Target percentage of energy savings above State standards																		
	Eec=	32.8%	Percent of single family electricity use covered by Title 24 (Statewide Energy Efficiency Collaborative [SEEC] 2011 Greenhouse Gas Forecasting Assistant, page 7)																		
	Egc=	85.7%	Percent of single family natural gas use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 7)																		
	CSP=	25%	Percent single family residential energy savings above current State standards (CEC 2013 Building Efficiency Standards, slide 11)																		
	Residential electricity use intensity=	3.5	kWh/square foot/year (Average electric use intensity for residential buildings in kWh/square foot/year [RASS]).																		
	Residential natural gas use intensity=	0.3	Therms/square foot/year (Average natural gas usage intensity for residential buildings in therms/square foot/year [RASS]).																		
$\text{Commercial Electricity Energy Savings (kWh)} = \text{E} \times \text{Egc} \times (1 - \text{CSP}) \times 12.95 \times \text{Csf}$ $\text{Commercial Natural Gas Savings (therms)} = \text{E} \times \text{Egc} \times (1 - \text{CSP}) \times 0.3 \times \text{Csf}$																					
Where:																					
<table border="1"> <tr> <td>Cu=</td> <td>50</td> <td># of commercial units or buildings audited by 2020</td> </tr> <tr> <td>Average commercial unit size=</td> <td>4,500</td> <td>Average square feet for all commercial buildings (Energy Information Administration)</td> </tr> <tr> <td>Csf=</td> <td>225,000</td> <td># of new square feet of commercial space that exceeds State standards by 2020</td> </tr> <tr> <td>E=</td> <td>20%</td> <td>Target percentage of energy savings above State standards</td> </tr> <tr> <td>Eec=</td> <td>64%</td> <td>Percent of commercial electricity use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)</td> </tr> <tr> <td>Egc=</td> <td>70%</td> <td>Percent of commercial natural gas use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)</td> </tr> </table>				Cu=	50	# of commercial units or buildings audited by 2020	Average commercial unit size=	4,500	Average square feet for all commercial buildings (Energy Information Administration)	Csf=	225,000	# of new square feet of commercial space that exceeds State standards by 2020	E=	20%	Target percentage of energy savings above State standards	Eec=	64%	Percent of commercial electricity use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)	Egc=	70%	Percent of commercial natural gas use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)
Cu=	50	# of commercial units or buildings audited by 2020																			
Average commercial unit size=	4,500	Average square feet for all commercial buildings (Energy Information Administration)																			
Csf=	225,000	# of new square feet of commercial space that exceeds State standards by 2020																			
E=	20%	Target percentage of energy savings above State standards																			
Eec=	64%	Percent of commercial electricity use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)																			
Egc=	70%	Percent of commercial natural gas use covered by Title 24 (SEEC 2011 Greenhouse Gas Forecasting Assistant, page 9)																			

	CSP=	30%	Percent non-residential energy savings above current State standards (CEC 2013 Building Efficiency Standards, slide 17)
	Commercial electricity use intensity=	12.954999	kWh/square foot/year (Average electric use intensity for commercial buildings in kWh/square feet/year (California Energy Commission [CEC] 2005 California End Use Survey [CEUS]))
	Commercial natural gas use intensity=	0.34999	therms/square foot/year (Average natural gas usage intensity for commercial buildings in therms/square feet/year (CEC 2005 CEUS))
Resource Savings	26,984	Residential electricity saved (kWh)	
	6,949	Residential natural gas saved (therms)	
	261,173	Commercial electricity saved (kWh)	
	7,717	Commercial natural gas saved (therms)	
GHG Emission Reduction Calculations	GHG Savings (MT CO2e) = (Se/1,000 × 0.133) + (Sg/10 × 53.2/1,000)		
	Where:		
	Se=	electricity savings	
	Sg=	natural gas savings	
	1,000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)	
	10	= conversion factor for therm to MMBtu	
	0.13	= average projected emissions factor for electricity in 2020 in MT CO2e/MWh	
	53.20	= average emissions factor for natural gas (kg CO2e/MMBtu)	
GHG Emission Reduction	41	Residential Reduction (MT CO2e/year)	
	76	Commercial Reduction (MT CO2e/year)	
Municipal Costs and Savings Calculations	Staff time developing new materials, identifying and adopting incentives.		
	FTE =	0.03	Estimated staff time per year to develop new program
	\$/FTE=	\$100,000	FTE cost
Municipal Costs and Savings	Municipal Cost=	\$2,500	Dollars per year
	Municipal Savings =	\$0	Dollars per year
Community Costs and Savings Calculations	Total savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms]		
	Where:		
	Residential \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Residential \$/therm=	\$0.92	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Commercial \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Commercial \$/therm=	\$0.81	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Total residential savings =	\$11,520	Residential Savings (\$/year)
	Total commercial savings =	\$54,829	Commercial Savings (\$/year)
	Average residential Cost =	\$0.91	Residential average cost to implement (sqft) - Projected PG&E Zone 5 Costs (US Department of Energy)
	Average commercial Cost =	\$1.25	Commercial average cost to implement (sq ft) - Projected PG&E Zone 5 Costs (CA Department of Energy)
	Residential Cost =	\$1,406	Dollars per household

Community Costs and Savings	Commercial Cost =	\$5,625	Dollars per business
	Residential Savings =	\$115	Dollars per household
	Commercial Savings =	\$1,097	Dollars per business

Notes

Title 24 covers only 64% of commercial electricity use and 70% of natural gas use (SEEC, page 7). 2013 Title 24 updates are expected to reduce non-residential energy use by 30% (CEC).

Title 24 covers only 32.8% of single family residential electricity use and 85.7% of natural gas use (SEEC, page 7). 2013 Title 24 updates are expected to reduce single family residential energy use by 25% and multifamily residential by 14% (CEC).

When combining energy measures, the City should be aware of double-counting emission reductions. Some actions in this measure overlap with actions in Measure 3k and 3l, and this overlay diminishes the overall effectiveness of the measure and its actions. If the City selects both measures, it should lower the commitment established in terms of units or percent reduction in order to address the issue of double-counting.

References

1. 2005 California End Use Survey <http://www.energy.ca.gov/ceus/>
2. CEC 2013 Building Efficiency Standards, slide 17 - http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2012-05-31_2013_standards_adoption_hearing_presentation.pdf
3. SEEC 2011 Greenhouse Gas Forecasting Assistant, page 7 - <http://californiaseec.org/documents/forecasting-tools/seec-forecast-assistant-documentation>
4. http://www.energy.ca.gov/title24/2008standards/ordinances/san_luis_obispo/CZ5_Cost-Effectiveness_Report-Final.pdf

Energy Efficient Public Realm Lighting Requirements

Calculation Methodology and Equations

Key Assumptions for Calculations:

Number of Private LED street lights installed by 2020	100	Street Lights
Number of Private LED traffic signals installed by 2020	0	Traffic Signals
Number of LED or CFL other outdoor lights installed by 2020	200	Other Outdoor Lights
Staff time needed for this measure	0.01	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Total electricity saved (kWh) = (N x (Wi-We) x (h/Cf))				
	Where Street Lights:				
	N _{street} =	100	Number of street lights installed lights		
	Wi =	200	Average estimated power rating in watts of high pressure sodium street light (Department of Energy [DOE] 2004. U.S. Lighting Market Characterization)		
	We =	50	Average power rating in watts of LED street lighting (DOE and PG&E 2008. LED Street Lighting)		
	h =	4,100	Number of hours per year operating		
	Cf =	1,000	Conversion factor for W to kW		
	Where Traffic Signals:				
	N _{traffic} =	0	Number of traffic installed lights		
	Wi =	150	Average estimated power rating in watts of incandescent traffic signal light (DOE 2004)		
	We =	15	Average power rating in watts of LED traffic signal light (DOE 2004)		
	h =	8,760	Number of hours per year operating (24 hours a day)		
	Cf =	1,000	Conversion factor for W to kW		
Where Other Private Outdoor Lighting (in Public Realm):					
N _{other} =	200	Number of other outdoor installed lights			
Wi =	150	Average estimated power rating in watts of public realm lighting (DOE 2004)			
We =	20	Average power rating in watts of LED public realm lighting (DOE 2004)			
h =	3,650	Number of hours per year operating			
Cf =	1,000	Conversion factor for W to kW			
Resource Savings	61,500	Electricity saved from LED street lights (kWh)			
	0	Electricity saved from LED traffic signals (kWh)			
	94,900	Electricity saved from LED "other" public realm lighting (kWh)			
	61,500	Total electricity saved (kWh)			
GHG Emission Reduction Calculations	GHG Savings (MT CO2e)=(Se/1,000 x 0.133)				
	Where:				
	Se=	electricity savings			
	1,000	= conversion factor for kWh to MWh			
GHG Emission Reduction	0.133 = average projected emissions factor for electricity in 2020 in MT CO2e/MWh				
	8	MT CO2e/year			
Municipal Costs and Savings Calculations	Staff time needed to develop and adopt ordinance. Would be incorporated into permitting process.				
	FTE =	0.01	Estimated staff time to develop requirements		
	\$/FTE=	\$100,000	Dollars		
	Maintenance savings per fixture =	\$17	Annual maintenance savings/fixture (City of Palo Alto)		
	Maintenance savings =	\$1,700	Dollars (for streetlights and traffic signals)		
Municipal Costs and Savings	Municipal Cost=	\$1,000	Dollars		
	Municipal Savings =	\$1,700	Dollars		
Total Savings = kWh reduced/year x \$/kWh					
Where:					

Community Cost and Savings Calculations	\$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Total capital savings =	\$11,685	Dollars
	Maintenance savings per fixture =	\$17	Annual maintenance savings/fixture (City of Palo Alto)
	Total maintenance savings =	\$3,400	Dollars (other public realm lighting)
	Total Capital Cost = [Number of units installed x cost per unit] – [Available rebates]		
	Where Streetlights:		
	Number of units installed =	100	Units
	Cost per unit installed =	\$350	Dollars/unit (Energy Solutions 2008; PNNL 2010)
	Total cost=	\$35,000	Dollars
	Available rebates =	\$125	Dollars/unit (\$125 for 200 watt unit replaced - PG&E)
	Net cost =	\$22,500	Dollars (total cost - available rebates)
	Where Traffic Signals:		
	Number of units installed =	0	Units
	Cost per unit installed =	\$193	Dollars/unit (assuming a standard three 12" (red, yellow, and green) balls per signal (Western Pacific Signal 2011; eLightBulbs 2011))
	Cost installation =	\$0	Dollars
	Available rebates =	\$100	Dollars (\$100 for 150 watt unit replaced - PG&E)
	Net cost =	\$0	Dollars (total cost - available rebates)
	Where Other Private Outdoor Lighting (in Public Realm):		
	Number of units installed =	200	Units
	Cost per unit installed =	\$300	Dollars/unit (Energy Solutions 2008; PNNL 2010)
	Cost installation =	\$60,000	Dollars
	Available rebates =	\$100	Dollars (\$100 for 150 watt unit replaced - PG&E)
	Net cost =	\$40,000	Dollars (total cost - available rebates)
	Community Cost =	\$208	Dollars per light
	Community Savings =	\$56	Dollars per light

Notes

1. PG&E Streetlight program -
<http://www.pge.com/mybusiness/energysavingsrebates/rebatesincentives/ref/lighting/lightemittingdiodes/streetlightprogram.shtml>
2. PG&E LED Street Light Turnkey Replacement Service -
<http://www.pge.com/mybusiness/energysavingsrebates/rebatesincentives/ref/lighting/lightemittingdiodes/ledturnkey/>
3. DOE U.S. Lighting Market Characterization Study. National Lighting Inventory and Energy Consumption Estimate -
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/lmc_vol1_final.pdf
4. DOE and PG&E LED Street Lighting study - http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_sf-streetlighting.pdf
5. IES Model Lighting Ordinance - http://www.ies.org/PDF/MLO/MLO_FINAL_June2011.pdf
6. PG&E LED Streetlight Rebates -
<http://www.pge.com/mybusiness/energysavingsrebates/rebatesincentives/ref/lighting/lightemittingdiodes/incentives/index.shtml>
7. Western Pacific Signal 2011; eLightBulbs 2011; Energy Solutions 2008; PNNL 2010 from Stockton Draft CAP -
<http://www.stocktongov.com/files/ClimateActionPlanDraftFeb2012.pdf>
8. Palo Alto - Demonstration Assessment of Light-Emitting Diode (LED) Roadway Lighting on Residential and Commercial Streets -
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_palo-alto.pdf

References

Small Solar Photovoltaic (PV) Incentive Program

Calculation Methodology and Equations

Key Assumptions for Calculations:

Number of commercial solar PV installations (between 2013-2020)	20	Systems
Number of residential solar PV installations (between 2013-2020)	185	Systems
Number of residential solar water heaters installed by 2020*	75	Systems
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

*Approximately 0.013 installations per household as a result of the Solar Water Heating program established under Assembly Bill 1470, the Solar Thermal Heating Act of 2007.

Calculations:

Resource Savings Calculations	Commercial Electricity Energy Savings (kWh)= $Csi \times Acsi \times 1,900$ Residential Electricity Energy Savings (kWh)= $(Rsi \times Arsi \times 1,900) + (Rsw \times Ee)$ Residential Natural Gas Energy Savings (therms) = $Rswg \times Eg$ Where:		
	Csi =	20	# of commercial solar installations by 2020
	Rsi =	185	# of residential solar installations by 2020
	Rsw =	8	# of residential solar electric water heater installations by 2020 (assumes 10% electric)
	Rswg =	68	# of residential solar natural gas water heater installations by 2020 (assumes 90% natural gas)
	Acsi =	33.8	average commercial solar installation size in kW (Cal Solar Initiative [CSI 1])
	Arsi =	4.6	average residential solar installation size in kW (CSI 1)
	Ee =	2,945	average expected residential solar water heater savings in kWh per year (California Solar Initiative (CSI 2) Thermal Program Cal Solar statistics)
	Eg =	139	average expected residential solar water heater savings in therms per year (CSI 2 - 2012 Thermal Program Cal Solar statistics)
	Conversion factor =	1,900	conversion factor from kW to kWh per year (Solar Energy Industries Association [SEIA] Solar Radiation Conversion Map)
Resource Savings	1,638,988	Residential electricity saved (kWh)	
	9,383	Residential natural gas saved (therms)	
	1,284,400	Commercial electricity saved (kWh)	
GHG Emission Reduction Calculations	GHG Savings (MT CO2e) = $(Se/1,000 \times 0.133) + (Sg/10 \times 53.2/1,000)$ Where:		
	Se=	electricity savings	
	Sg=	natural gas savings	
	1,000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)	
	10	= conversion factor for therm to MMBtu	
	0.133	= average projected emissions factor for electricity in 2020 in MT CO2e/MWh	
	53.20	= average emissions factor for natural gas (kg CO2e/MMBtu)	
GHG Emission Reduction	439	MT CO2e	
Municipal Costs and Savings Calculations	Staff time developing new materials and performing marketing and outreach activities.		
	FTE =	0.05	Estimated staff time per year to develop new program
	\$/FTE	\$100,000	Dollars per year
Municipal Costs and Savings	Municipal Cost =	\$5,000	Dollars per year
	Municipal Savings =	\$0	Dollars per year
	Commercial cost savings = [Electricity Savings x \$/kWh] Residential cost savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms] Where:		
	Residential \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Commercial \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast

Community Costs and Savings Calculations	Residential \$/therm =	\$0.92	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast
	Total residential savings =	\$320,040	Dollars
	Total commercial savings =	\$238,898	Dollars
	Commercial solar installed cost =	\$4.38	Commercial Solar Installations per watt (Green Tech Media)
	Residential solar installed cost =	\$5.46	Residential Solar Installations per watt (Green Tech Media)
	Total cost of installed commercial solar =	\$2,960,880	Dollars
	Total cost of installed residential solar =	\$4,646,460	Dollars
	Residential solar water heater cost =	\$4,650	Dollars (Incremental installed cost of solar hot water heater (National Renewable Energy Lab, August 2012))
	Available rebates =	\$2,175	Dollars (available Rebate for replacing natural gas heater with solar (Go Solar CA))
	Cost of solar hot water heater with rebate =	\$2,475	Dollars (cost of solar hot water heater installation minus rebate)
Community Cost and Savings	Total cost of solar water heaters =	\$185,625	Dollars
	Residential Cost =	\$18,585	Dollars per household
	Commercial Cost =	\$148,044	Dollars per business
	Residential Savings =	\$1,231	Dollars per household
	Commercial Savings =	\$11,945	Dollars per business

Notes

Commercial and residential installation size assumptions are the averages for San Luis Obispo County PV installations for completed and PBI projects (Cal Solar). The installation size uses the CSI rating, which accounts for a design factor, and is a more accurate reflection of energy generated by the installation. Solar water heater savings is an average of the expected savings for all the projects that have applied for the CSI-Thermal rebate in San Luis Obispo County (CSI 2).

When combining energy measures, the City should be aware of double-counting emission reductions. Should not double count with Measure 3k, Low Income Solar Program, and Measure 3q, Municipal Solar Installations.

The model assumes that solar water heaters are installed in combination with both electric and natural gas water heaters. The model assumes that 90% of the systems installed offset natural gas water heaters; 10% offset electric water heaters.

Installed cost of conventional natural gas system is \$1,350 and installed cost of residential solar water heaters: \$6,000 (National Renewable Energy Lab).

References

1. Cal Solar - <http://www.californiasolarstatistics.ca.gov/>
2. California Solar Initiative CSI-Thermal Program - <http://www.gosolarcalifornia.ca.gov/solarwater/index.php>
3. CEC Planning and Permitting Resources For Renewable Energy Systems - http://www.energy.ca.gov/localgovernment/planning_resources/
4. SEIA Solar Radiation Conversion Map - <http://www.getsolar.com/blog/what-can-one-kilowatt-of-solar-do-for-you/13483/>
5. <http://www.nrel.gov/docs/fy11osti/48986.pdf>
6. <http://www.greentechmedia.com/research/ussmi>
7. National Renewable Energy Lab, August 2012 - <http://www.nrel.gov/solar/>
8. Go Solar CA - <http://www.gosolarcalifornia.ca.gov/>

Income-Qualified Solar PV Program

Calculation Methodology and Equations

Key Assumptions for Calculations:

Number of low-income residential solar PV installations by 2020	104	Systems
Number of low-income residential solar water heaters installed by 2020	25	Systems
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Residential Electricity Energy Savings (kWh)= $(Rsi \times Arsi \times 1,900) + (Rsw \times Ee)$ Residential Natural Gas Energy Savings (therms) = $Rswg \times Eg$				
	Rsi=	104	# of low-income residential solar PV installations		
	Rsw=	2.5	# of low-income residential solar electric water heater installations by 2020 (assumes 10% electric)		
	Rswg=	22.5	# of residential solar natural gas water heater installations by 2020 (assumes 90% natural gas)		
	Arxi=	4.6	average residential solar installation size in kW (Cal Solar Initiative [CSI 1])		
	Ee=	2,945	average expected residential solar water heater savings in kWh per year (California Solar Initiative (CSI 2) Thermal Program Cal Solar statistics)		
	Eg=	139	average expected residential solar water heater savings in therms per year (CSI 2 - 2012 Thermal Program Cal Solar statistics)		
	Conversion factor=	1,900	conversion factor from kWh to kWh per year (Solar Energy Industries Association [SEIA] Solar Radiation Conversion Map)		
Resource Savings	916,323	Residential electricity saved (kWh)			
	3,128	Residential natural gas saved (therms)			
GHG Emission Reduction Calculations	GHG Savings (MT CO2e) = $(Se/1,000 \times 0.133) + (Sg/10 \times 53.2/1,000)$				
	Where:				
	Se=	electricity savings			
	Sg=	natural gas savings			
	1,000	= conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)			
	10	= conversion factor for therm to MMBtu			
	0.13	= average projected emissions factor for electricity in 2020 in MT CO2e/MWh			
GHG Emission Reductions	53.20	= average emissions factor for natural gas (kg CO2e/MMBtu)			
	139	MT CO2e			
Municipal Costs and Savings Calculations	Staff time for collaboration and outreach.				
	FTE =	0.05	Estimated staff time per year to develop new program		
	\$/FTE=	\$100,000	Dollars per year		
Municipal Costs and Savings	Municipal Cost=	\$5,000	Dollars per year		
	Municipal Savings =	\$0	Dollars per year		
Community Costs and Savings Calculations	Residential savings = [Electricity Savings x \$/kWh] + [Natural Gas Savings x \$/therms]				
	Where:				
	Residential \$/kWh=	\$0.19	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		
	Residential \$/therm=	\$0.92	California Energy Commission, California Energy Demand 2010-2020, Adopted Forecast		

	Total residential savings =	\$176,979	Dollars
Community Costs and Savings	Community Cost =	\$0	Dollars per household (Assumes to be paid for through programs.)
	Community Savings =	\$1,372	Dollars per household

Notes

Residential installation size assumptions are the averages for San Luis Obispo County PV installations for completed projects (Cal Solar 1). The installation size uses the CSI rating, which accounts for a design factor, and is a more accurate reflection of energy generated by the installation. Solar water heater savings is an average of the expected savings for all the projects that have applied for the CSI-Thermal rebate in San Luis Obispo County (Cal Solar 2).

When combining energy measures, the City should be aware of double-counting emission reductions. Some actions in this measure overlap with actions in Measures 3q, and this overlay diminishes the overall effectiveness of the measure and its actions. If the City selects both measures, it should lower the commitment established in terms of units or percent reduction in order to address the issue of double-counting.

The model assumes that solar water heaters are installed in combination with both electric and natural gas water heaters. The model assumes that 90% of the systems installed offset natural gas water heaters; 10% offset electric water heaters.

References

1. California Solar Initiative (CSI) - <http://www.californiasolarstatistics.ca.gov/>
2. California Solar Initiative CSI-Thermal Program - <http://www.gosolarcalifornia.ca.gov/solarwater/index.php>
3. CEC Planning and Permitting Resources For Renewable Energy Systems - http://www.energy.ca.gov/localgovernment/planning_resources/
4. SEIA Solar Radiation Conversion Map - <http://www.getsolar.com/blog/what-can-one-kilowatt-of-solar-do-for-you/13483/>

Bicycle Network

Calculation Methodology and Equations

Key Assumptions for Calculations:

Miles of new bike lane by 2020	2	Miles
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	VMT Reduction = (A*B)+(A*D)		
	City Area =	5.84	Square Miles
	Forecast VMT (2020) =	92,672,596	VMT in 2020
	Decrease in VMT (B) =	0.3%	Estimated VMT reduction factor for incorporating bike lanes into street design (CAPCOA) (Assumes 1% decrease in VMT per mile of new bike lane per square mile area. Maximum reduction capped at 1% to avoid double counting from alternative travel related VMT reductions.)
	VMT reduction for installing bicycle racks (D)=	0.06%	Percent - (CAPCOA, SDT-6)
Resource Savings	Total VMT Reduction =	375,756	VMT per year
GHG Emission Reduction Calculations	GHG Savings = VMT Reduction × Cef		
	Where: Cef =	0.000374	Composite emission factor; MT CO2 per VMT (EMFAC 2011)
GHG Emission Reduction	Total GHG Savings =	140	MT CO2e
Municipal Costs and Savings Calculations	Staff time required for developing policies and acquiring grant funding for bicycle infrastructure. There would be minimal additional costs associated with staff time needed for plan checks; however, this cost will be absorbed through development/permitting fees.		
	FTE =	0.05	Estimated staff time per year to develop new program
	\$/FTE=	100,000	Dollars per year
Municipal Costs and Savings	Municipal Cost =	\$5,000	Dollars (Assumes that grant funding would be used to implement bicycle infrastructure. Minimal costs would occur as a result of incorporating multi-modal improvements into pavement resurfacing, restriping, and signalization operations (less than \$5,000).)
	Municipal Savings =	\$0	Dollars
Community Costs and Savings Calculations	Community VMT Reduced=	375,756	Dollars per year
	Community operating cost per mile =	\$0.56	Dollars
	Average round trip length =	17.82	Miles (Fehr & Peers)
	Round trips switching from driving to biking =	21,086	Round trips
	Cost per mile of new bicycle lane =	\$40,000	Dollars per mile (Assumes \$40,000 per mile average. Actual cost would depend on the type of bicycle lane being installed - see notes below)
	Total cost of new bicycle lanes =	\$80,000	Dollars

	Cost of bicycle parking =	\$0	Dollar (Bicycle parking standards for non-residential development went into effect January 1, 2001 as part of California Green Building Standards Code, and are therefore now a cost associated with doing business-as-usual)
Community Costs and Savings	Community Cost =	\$0	Dollars per person (Assumes cost of bike lanes would be incurred by the City through grant funding and private developers.)
	Community Savings =	\$10	Dollars per trip (Savings varies depending on how many bicycle trips are made by a single person.)

Notes

Calculation methodology derived from CAPCOA measures SDT-5 and SDT-6

The following is provided for informational purposes:

Cost of infrastructure development is highly variable. Cost estimates for bicycle infrastructure: Class I Bike Path - approximately \$1,000,000 per mile; Class II Bike Lanes - \$10,000 - \$1,000,000 per mile (depending on level of roadway improvement required); Class III Bike Routes - \$2,000 - \$60,000 per mile (depending on the level of treatment; route signage only would be lower end, signage and shoulder striping, pavement markings, signal actuation would be higher end). The cost per mile of sidewalk is approximately \$250,000.

References and Links

1. CAPCOA, Quantifying Greenhouse Gas Mitigation Measures (2010):
<http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>
2. Cambridge Systematics. Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions (2009).
http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf
3. Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions. (p.13)
<http://www.airquality.org/ceqa/GuidanceLUEmissionReductions.pdf>
4. US Department of Transportation, <http://www.nhtsa.gov/people/injury/pedbimot/bike/Safe-Routes-2002/safe.html#8>
5. SLO COG RTP - http://www.slocog.org/cm/Programs_and_Projects/2010_Regional_Transportation_Plan.html

Pedestrian Network

Calculation Methodology and Equations

Key Assumptions for Calculations:

Miles of new sidewalk added by 2020	4	Miles
Staff time needed for this measure*	0	Full Time Equivalent (FTE)

*Already have staff doing this. Included in CIP.

Calculations:

Resource Savings Calculations	VMT Reduction = Forecast VMT x Percent VMT reduction		
	City Area =	5.84	Square Miles
	Forecast VMT (2020) =	92,672,596	VMT
	Percent VMT reduction from pedestrian network improvements=	0.3%	Percent reduction in VMT (CAPCOA SDT-1)
Resource Savings	Total VMT Reduction =	317,372	VMT per year
GHG Emission Reduction Calculations	GHG Savings = VMT Reduction x Cef		
	Where: Cef =	0.000374	Composite emission factor; MT CO2 per VMT (EMFAC 2011)
GHG Emission Reduction	Total GHG Savings =	119	MT CO2e
Municipal Costs and Savings Calculations	Staff time required for review and approval of projects and acquiring grant funding for pedestrian infrastructure.		
	FTE =	0.0	Estimated staff time per year to develop new program
	\$/FTE=	100,000	Dollars per year
Municipal Costs and Savings	Municipal Cost =	\$0	Dollars (Assumes that grant funding would be used to implement pedestrian infrastructure. Minimal costs would occur as a result of incorporating multi-modal improvements into pavement resurfacing, restriping, and signalization operations (less than \$5,000).)
	Municipal Savings =	\$0	Dollars
Community Costs and Savings Calculations	Community VMT Reduced=	317,372	Dollars per year
	Community operating cost per mile =	\$0.56	Dollars
	Cost per mile of new sidewalk =	\$250,000	Dollars per mile
	Total cost of new bicycle lanes =	\$1,000,000	Dollars
Community Costs and Savings	Community Cost =	\$0	Dollars per person (Assumes cost would be incurred by the City through grant funding and the private developer.)
	Community Savings =	Varies	Dollars per person (Varies based on number of trips made by foot and distance travelled. Savings of \$0.555 per mile.)

Notes

Calculation methodology derived from CAPCOA measure SDT-1

References

1. CAPCOA, Quantifying Greenhouse Gas Mitigation Measures (2010): <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>
2. Cambridge Systematics. Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions (2009). http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf
3. Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions. (p.13) <http://www.airquality.org/ceqa/GuidanceLUEmissionReductions.pdf>

Transit Travel

Calculation Methodology and Equations

Note: GHG reductions from this measure are quantified under Measures TL-4 and TL-7.

Calculations:

GHG Emission Reduction	Total GHG Savings =	0	MT CO2e
Municipal Costs and Savings Calculations	Annual staffing costs associated with coordination and marketing.		
	FTE =	0.05	Estimated cost of staff time
Municipal Costs and Savings	\$/FTE =	\$100,000	Total annual cost per FTE
	Municipal Cost =	\$5,000	Dollars
Community Costs and Savings	Municipal Savings =	\$0	Dollars
	Community Cost =	\$0	Dollars
	Community Savings =	\$0	Dollars

Notes

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References

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Transportation Demand Management (TDM) Incentives

Calculation Methodology and Equations

Key Assumptions for Calculations:

Targeted percent of employees participating	15%	Percent
Staff time needed for this measure	0.02	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	VMT Reduction = Forecast Employee Commute VMT x (A x B)		
	Where:		
	Forecast Annual VMT (2020) =	92,672,596	VMT in 2020
	Forecast Annual Employee Commute VMT (2020) =	15,661,669	Employee commute VMT in 2020 (16.9% of total VMT, Fehr & Peers)
	Percent Reduction in Commute VMT (A) =	4%	Percent (4% from CAPCOA, page 240)
Resource Savings	Percent of Employees Participating (B) =	15%	Percent of employees to participate in the TDM program
	VMT Reduction =	93,970	VMT in 2020
GHG Emission Reduction Calculations	GHG Reduction = VMT Reduction x Cef		
	Where:		
	Cef =	0.000374	Composite emission factor; MT CO2 per VMT (EMFAC 2011)
GHG Emission Reduction	Total GHG Savings =	35	MT CO2e
Municipal Costs and Savings Calculations	Annual staffing costs associated with coordination and marketing.		
	FTE =	0.02	Estimated cost of staff time
	\$/FTE =	\$100,000	Total annual cost per FTE
Municipal Costs and Savings	Municipal Cost =	\$2,000	Dollars
	Municipal Savings =	\$0	Dollars
Community Cost and Savings Calculations	Private VMT Reduced =	93,970	VMT
	Private vehicle operating cost per mile =	\$0.56	Dollars per mile
	Total community savings =	\$52,153	Dollars
	Total employees =	5,800	Employees (projected in 2020)
	Employees participating in TDM =	870	Employees
Community Costs and Savings	Community Cost =	\$0	Dollars per employee
	Community Savings =	\$60	Dollars per employee

Notes

Calculation methodology derived from CAPCOA measures TRT-7, page 240.

References

1. CAPCOA, Quantifying Greenhouse Gas Mitigation Measures (2010):
<http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>
2. Fehr & Peers calculation of countywide VMT associated with employee commute from the San Luis Obispo Council of Governments Regional Traffic Model 2.0, November 2012.

Parking Supply Management

Calculation Methodology and Equations

Key Assumptions for Calculations:

Implementation Year	2015	Year
Net reduction in parking spaces	100	Parking Spaces
New parking spaces by 2020 forecast under existing regulations	4,000	Parking Spaces
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	VMT Reduction = VMT Growth x (((N - O)/O) x 0.5)		
	Baseline VMT (2005) =	80,163,593	Annual Vehicle Miles Traveled (VMT)
	Forecast VMT (2020) =	92,672,596	Annual VMT
	VMT Growth =	4,169,668	VMT generated by forecast development between implementation year and 2020
	N =	3,900	Parking spaces forecast under proposed regulations. (Placeholder value assumes 1,000,000 square feet of new development and 3.5 spaces per 1,000 square feet)
	O =	4,000	Parking forecast under existing regulations. (Placeholder value assumes 1,000,000 square feet of forecast development and 4 spaces per 1,000 square feet)
	P =	0.5	Estimated ratio of reduction in parking supply to reduction in vehicle trips (CAPCOA PDT-1)
	Percent change =	-3%	Percent change in new parking supply
Resource Savings	Annual VMT Reduction =	52,121	Annual reduction in VMT (CAPCOA PDT-1)
GHG Emission Reduction Calculations	GHG Savings = VMT Reduction x Cef		
	Where:		
	2020 Composite Emissions Factor Cef=	0.000374	Composite emission factor; MT CO2 per VMT (EMFAC 2011)
GHG Emission Reduction	Total GHG Savings =	19	MT CO2e
Municipal Costs and Savings Calculations	Staff time to develop policy and establish in-lieu fees.		
	FTE =	0.05	Estimated staff time per year
	\$/FTE=	\$100,000	FTE cost per year
Municipal Costs and Savings	Municipal Cost =	\$5,000	Dollars
	Municipal Savings =	\$0	Dollars
Community Costs and Savings Calculations	Private costs and savings of increasing transit service, scaled to City population. Change in private costs = (A*B)+((D*E)/G)		
	Private VMT Reduced (A) =	52,121	VMT
	Private vehicle operating cost per mile (B) =	\$0.56	Dollars per mile
	Private Savings from avoided driving (C) =	\$28,927	Dollars
	Reduction in required parking spaces (D) =	100	Reduction in required parking spaces

	Surface parking construction costs (Excludes cost of land) =	\$10,000	Dollars per space (U.S. parking structure construction costs are reported to average about \$15,000 per space in 2008. Adjusted to reflect cost of ground floor spaces.) (Victoria Transport Policy Institute)
	Total cost savings from reduced parking construction (F) =	\$1,000,000	Dollars (This is a savings for the project applicant/developer, not the general public.)
Community Costs and Savings	Community Cost =	\$0	Dollars per parking space reduced
	Community Savings =	\$289	Dollars per parking space reduced (Excludes savings to private developers.)

Notes

Calculation methodology derived from CAPCOA measure PDT-1.

References

1. California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures (August 2010): <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>
2. Nelson\Nygaard (2005). Crediting Low-Traffic Developments (p. 16): <http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf>
3. SF Bay Area Metropolitan Transportation Commission Parking Code Guidance - http://www.mtc.ca.gov/planning/smart_growth/parking/6-12/Parking_Code_Guidance_June_2012.pdf
4. Victoria Transport Policy Institute - www.vtpi.org/tca/tca0504.pdf

Electric Vehicle Network and Alternative Fueling Stations

Calculation Methodology and Equations

Key Assumptions for Calculations

Percent Adoption of Electric Vehicles Based on Implementation of Comprehensive EV Network	5%	Percent
Staff time needed for this measure	0.1	Full Time Equivalent

Calculations:

GHG Emission Reduction Calculations	GHG reduction = (City Forecast VMT x B) x D		
	City Forecast VMT (2020) =	92,672,596	VMT
	Estimated percent of drivers switching to EV's by 2020 (B) =	5%	Percent
	VMT driven by those shifting to EV's (C) =	4,633,630	VMT
	Default composite emissions factor =	0.000374	MT CO2e per VMT
	Emissions factor for plug-in hybrid vehicle =	0.000146	MT CO2e per VMT (Ex. Toyota Prius Plug-in Hybrid, http://www.google.org/recharge/experiment/CO2.html)
	Emissions-per mile difference between average car and EV (D) =	0.000228	MT CO2e per VMT
GHG Emission Reduction	Total GHG Savings =	1,056	MT CO2e
Municipal Costs and Savings Calculations	Staff time needed for EV Readiness streamlining and coordination with APCD and Central Coast Clean Cities Coalition. (A specific program of investments has not yet been identified by APCD and the Central Coast Clean Cities Coalition. It is expected that localities would seek outside funds to support investments in EV charging stations and alternative fuel stations.)		
	FTE =	0.1	Estimated staff time to develop new program
	\$/FTE =	\$100,000	Total annual cost per FTE
Municipal Costs and Savings	Municipal Cost =	\$5,000	Dollars
	Municipal Savings =	\$0	Dollars
Community Costs and Savings Calculations	Cost of EV charging station =	\$8,000	Dollars (Average total cost for commercial charging station including hardware and installation for AC Level 2, 7.5 kW, 240V Charger) (Ready Set Charge California)
Community Costs and Savings	Community Cost =	\$0	Dollars per charging station (Assumes cost of EV charging stations would be incurred by private developer. Developer costs may be covered by applicable grants.)
	Community Savings =	\$0	Dollars per charging station

Notes

References

1. Argonne National Laboratory. 2009. Multi-Path Transportation Futures Study: Vehicle Characterization and Scenario Analyses. ANL/ESD/09-5. Table 3-11a, p. 53.).
2. "Electric Vehicle Infrastructure, A Guide for Local Governments in Washington State: Model Ordinance, Model Development Regulations, and Guidance Related to Electric Vehicle Infrastructure and Batteries per RCW 47.80.090 and 43.31.970." http://www.psrc.org/assets/4325/EVI_full_report.pdf
3. RechargeIT Driving Experiment: Demonstration of energy efficiency for electric vehicles. Google, org, 2007. http://www.google.org/recharge/
4. Ready, Set, Charge California - A Guide to EV Ready Communities - http://www.rmi.org/Content/Files/Readystcharge.pdf

Smart Growth

Calculation Methodology and Equations

Note: This measure was quantified by Fehr & Peers utilizing the Regional Travel Model.

Key Assumptions for Calculations:

Percent of new residential units located within 0.25 miles of transit by 2020	25%	Percent
Percent of new jobs located within 0.25 miles of transit by 2020	25%	Percent
% Reduction in VMT	5%	Percent
Staff time needed for this measure	0.08	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	VMT Reduction = new residences x persons per household x per capita VMT reduction		
Resource Savings	Annual VMT Reduction =	4,633,630	Vehicle miles traveled
GHG Emission Reduction Calculations	GHG Savings = VMT Reduction x Cef		
	Where: Cef =	0.000374	Composite emission factor; MT CO2 per VMT (EMFAC 2011)
GHG Emissions Reduction	Total GHG Savings =	1,731	MT CO2e
Municipal Costs and Savings Calculations	Staff time needed to identify incentives and update codes and regulations.		
	FTE =	0.1	Estimated staff time to develop new program
	\$/FTE =	\$100,000	Total annual cost per FTE
Municipal Costs and Savings	Municipal Cost =	\$8,000	Dollars
	Municipal Savings =	\$0	Dollars
Community Costs and Savings Calculations	Private developers will gain from a wider choice of potential development opportunities, costs of which would vary based on the incentives provided.		
	Private VMT reduced =	4,633,630	VMT
	Private vehicle operating cost per mile =	\$0.56	Private vehicle operating cost per mile
	Private savings from avoided driving =	\$2,571,665	Private savings from avoided driving.
	Community Cost =	Varies	Dollars per unit
	Community Savings =	\$51,433,291	Dollars per unit

Notes

CAPCOA measures LUT- (see link below); users should consult detailed CAPCOA guidance and example calculations when using this methodology.

References

1. CAPCOA, Quantifying Greenhouse Gas Mitigation Measures (2010):
<http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>
3. Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p.12). Journal of the American Planning Association:
<http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf>
4. Boarnet, Marlon and Handy, Susan. 2010. "Draft Policy Brief on the Impacts of Residential Density Based on a Review of Empirical Literature."
5. Criterion Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes. Technical Memorandum prepared for US EPA, October 2001.
6. TCRP Report 95, Transit Oriented Development Traveler Response to Transportation System Changes, Transit Oriented Development. (p 17-35)
http://www.fta.dot.gov/documents/Transit_Oriented_Development_-_Traveler_Response_to_Transportation_System_Changes_TCRP_Report_95.pdf
7. ICLEI CAPPA version 1.5 - Transit Oriented Development tab

Equipment Upgrades, Retrofits, and Replacements

Calculation Methodology and Equations

Key Assumptions for Calculations:

Is this measure selected in conjunction with Measure 5a - Construction Equipment Efficiency?	No	Yes or No
Percentage of off-road equipment replaced with electric equipment	10%	Percent
Percentage of off-road equipment replaced with alternative fuels	10%	Percent
Staff time needed for this measure	0.03	Full Time Equivalent (FTE)

Calculations:

GHG Emission Reduction Calculations	GHG Emissions Reduced = Reduction from Replacement with Electric Equipment + Reduction from Alternative Fuels	
	1 - GHG Reduced from Replacement with Electric Equipment = Forecast Construction Emissions x Percent Equipment Replaced x (Percent Diesel Equipment x Diesel Reduction) x (Percent Gasoline Equipment x Gasoline Reduction)	
	2 - GHG Emissions Reduced from Alternative Fuels = Forecast Construction Emissions x Percent Equipment Replaced x (Percent Diesel Equipment X Diesel Reduction) x (Percent Gasoline Equipment x Gasoline Reduction)	
	Total Forecast (2020) Off-Road GHG Emissions =	4,929 MT CO2e
	Forecast (2020) Off-Road GHG Emissions from Construction Equipment =	3,737 MT CO2e
	Percentage GHG Emissions from Diesel Equipment =	90% Percent
	Percentage GHG Emissions from Gasoline Equipment =	8% Percent
	Percentage GHG Emissions from Compressed Natural Gas =	2% Percent
	GHG Reduction from Replacing Diesel Equipment with Electric Equipment =	72.9% Percent (CAPCOA C-2, page 421)
	GHG Reduction from Replacing Gasoline Equipment with Electric Equipment =	72.4% Percent (CAPCOA C-2, page 421)
	GHG Reduction from Purchase of Electric Equipment =	352 MT CO2e
	Emission Reduction Due to Fuel Switch from Diesel to Compressed Natural Gas =	18% Percent (CAPCOA C-1, page 415)
	Emission Reduction Due to Fuel Switch from Gasoline to Compressed Natural Gas =	20% Percent (CAPCOA C-1, page 415)

	GHG Reduction from Use of Alternative Fuels =	88	MT CO2e
GHG Emission Reduction	Total GHG Reduction =	440	MT CO2e
Municipal Costs and Savings Calculations	Staff time needed to conduct outreach and promotional activities.		
	FTE =	0.0	Estimated staff time per year
Municipal Costs and Savings	\$/FTE =	\$100,000	FTE cost per year
	Municipal Cost =	\$3,000	Dollars
Community Costs and Savings	Municipal Savings =	\$0	Dollars
	Community Cost =	\$0	Dollars (Assumes equipment replacement and upgrades would be funded through the Carl Moyer program.)
	Community Savings =	Varies	Dollars (Varies based on vehicle/equipment replacement type.)

Notes

If used in conjunction with measure 5a, emissions reductions associated with upgrading construction equipment are removed to avoid double-counting.

Off-Road GHG Emissions were calculated from County-wide data from OFF-ROAD 2007.

Emissions reduction percentages from switching from diesel to compressed natural gas and from gasoline to compressed natural gas were calculated using the averages for all construction equipment type and horsepower categories for 2020 Tables in CAPCOA, C-1.

References

1. California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures (August 2010): C-1, C-2, C-3
2. California Air Resources Board (ARB). Off-road Emissions Inventory. OFFROAD2007

Recycling at Public Events

Calculation Methodology and Equations

Key Assumptions for Example Calculations Below:

Percentage of recycling at events	90%	Percent Effectiveness
Average number of visitors per event	350	Visitors/Event
Average number of events per year	15	Events/Year
Staff time needed for this measure	0.05	Full Time Equivalent (FTE)

Calculations:

Resource Savings Calculations	Waste Generation at Public Event = Visitors Per Event x Events per Year x (Pounds of Trash Per Visitor/2000)		
	Average Waste Generated per Visitor =	2.44	Pounds of Waste/Visitor (CA Integrated Waste Management Board, June 2009)
	2000 = Conversion from pounds to tons		
	Total Event Waste =	6	Tons
	Event Paper Products =	38.9%	Percent of Total Event Waste
	Event Food Waste =	18.4%	Percent of Total Event Waste
	Event Plant Debris =	17.9%	Percent of Total Event Waste
	Event Wood/Textiles =	1.8%	Percent of Total Event Waste
Resource Savings	Event All Other Waste =	23.0%	Percent of Total Event Waste
	Event Paper Products =	2.49	Tons
	Event Food Waste =	1.18	Tons
	Event Plant Debris =	1.15	Tons
	Event Wood/ Textiles =	3.88	Tons
GHG Emission Reduction Calculations	Event All Other Waste =	0.00	Tons
	Total MT CO2e Diverted = (2.138)(Event Paper Products)(0.9072) + (1.120)(Event Food Waste)(0.9072) + (0.686)(Event Plant Debris)(0.9072) + (0.605)(Event Wood/Textiles)(0.9072) + (0.00)(Event All Other Waste)(0.9072)		
	1 - Emission Reduction Per Waste Category = Emissions Factor for Category x Future Year Category Tonnage Diverted x 0.9072		
	0.9072	= Conversion from short tons to metric tons	
	Emission Factor - Paper Products =	2.138	MT CO2e / MT waste
	Emission Factor - Food Waste =	1.210	MT CO2e / MT waste
	Emissions Factor - Plant Debris =	0.686	MT CO2e / MT waste
	Emission Factor - Wood/Textiles =	0.605	MT CO2e / MT waste
	Emission Factor - All Other Waste =	0.000	MT CO2e / MT waste
	Emissions from Event Paper Products =	1.93	Metric Tons CO2e

Emissions from Event Food Waste =	0.52	Metric Tons CO2e	
Emissions from Event Plant Debris =	0.29	Metric Tons CO2e	
Emissions from Event Wood/Textiles =	0.85	Metric Tons CO2e	
Emissions from Event All Other Waste =	0.00	Metric Tons CO2e	
Emissions captured at landfill =	60%	Percent	
GHG Emission Reduction	Total GHG Emissions Reduction Accounting for Effectiveness and Implementation =	3	Metric Tons of CO2
Municipal Costs and Savings Calculations	Cost may include additional staff time.		
	FTE =	0.05	Estimated staff time per year
	\$/FTE =	\$100,000	FTE cost per year
Municipal Costs and Savings	Municipal Costs=	\$5,000	Dollars
	Municipal Savings=	\$0	Dollars
Community Costs and Savings	Community Costs =	\$0	Dollars
	Community Savings =	\$0	Dollars

Notes

ICLEI's CACP software incorporates emission factors for the diversion of certain materials from the waste stream, derived from the EPA WARM model. GHG Emissions Calculations assume a landfill methane recovery rate of 60%.

References

1. ICELI's Clean Air Climate Protection (CACP) Software (for members) available at: <http://www.icleiusa.org/action-center/tools/cacp-software>
2. EPA's WARM tool for additional information on estimating lifecycle impacts is available at: http://www.epa.gov/climatechange/wyccd/waste/calculators/Warm_home.html
3. California Integrated Waste Management Board's June 2006 report, "Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups." Available at: <http://www.calrecycle.ca.gov/Publications/Documents/Disposal%5C34106006.pdf>

Tree Planting Program

Calculation Methodology and Equations

Note: There is no reduction in GHG emissions associated with preservation of existing trees or mitigation of trees removed.

Key Assumptions for Calculations:

Target number of trees planted (net new trees)	500	Trees
City subsidy of tree cost and planting	25%	Percent Subsidized by City
Cost per tree	\$60	Dollars per Tree
Staff time needed for this measure	0.08	Full Time Equivalent (FTE)

Calculations:

GHG Emission Reduction Calculations	GHG Emissions Reduction=Number of Trees Planted x Carbon Sequestration Rate		
	0.0121	= Average carbon sequestration rate (MT CO ₂ /Tree)	
	500	= Number of Trees Planted	
GHG Emission Reduction	Total GHG Emissions Reduced =	6	MT CO ₂ e
Municipal Costs and Savings Calculations	Cost per tree =	\$60	Dollars/tree (McPherson, et al)
	City subsidy of tree cost and planting =	25%	Percent subsidized
	City cost per tree =	\$15	Dollars per tree
	Total capital cost=	\$7,500	Dollars
	FTE =	0.08	Estimated staff time to develop program
	\$/FTE	\$100,000	FTE cost per year
	Cost of staff time =	\$8,000	Dollars
Municipal Costs and Savings	Municipal Cost =	\$15,500	Dollars
	Municipal Savings =	\$0	Dollars
Community Costs and Savings Calculations	Capital cost = (cost per tree x number of trees planted x percentage of city subsidy)		
	Where:		
	Community cost per tree =	\$45	Dollars/tree
	Number of trees planted =	500	Trees
	Total tree capital cost (for community)=	\$22,500	Dollars
	Maintenance cost = maintenance cost per tree x number of trees planted. (Assumes community covers all maintenance costs.)		
	Maintenance cost=	\$34	Dollars/tree (McPherson, et al)
Community Costs and Savings	Total maintenance cost (for community) =	\$17,000	Dollars
	Community Cost =	\$79	Dollars per tree
	Community Savings =	\$0	Dollars per tree

Notes

Carbon sequestration rate from CAPCOA Quantifying GHG Mitigation Measures Report p. 403. There is no reduction in GHG emissions associated with preservation of existing trees or mitigation of trees removed. Account for net new trees only.

References

1. California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures (August 2010) - pg. 403
2. McPherson, et al as cited in Stockton Draft CAP - <http://www.stocktongov.com/government/boardcom/clim.html>

Climate Change Vulnerability

Calculation Methodology and Equations

Key Assumptions for Calculations:

Staff time needed for this measure	0.02	Full Time Equivalent (FTE)
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Calculations:

GHG Emission Reduction	Annual GHG emissions reduced =	N/A	MT CO2e
Municipal Costs and Savings Calculations	Staff time needed to participate in meetings and planning activities and incorporate new adaptation measures into City documents as appropriate.		
	FTE =	0.02	Estimated staff time per year
	\$/FTE =	\$100,000	FTE cost per year
	Staff time cost =	\$2,000	Dollars
Municipal Costs and Savings	Municipal Cost =	\$2,000	Dollars
	Municipal Savings =	\$0	Dollars

Notes

References

Public Health and Emergency Preparedness

Calculation Methodology and Equations

Key Assumptions for Calculations:

Staff time needed for this measure	0.08	Full Time Equivalent (FTE)
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Calculations:

GHG Emission Reduction	Annual GHG emissions reduced =	N/A	MT CO2e
Municipal Costs and Savings Calculations			Staff time needed to time to coordinate with other agencies and community-based organizations. Additional staff time needed for community education and outreach related to this measure.
	FTE =	0.08	Estimated staff time per year
	\$/FTE =	\$100,000	FTE cost per year
	Staff time cost =	\$8,000	Dollars
Municipal Costs and Savings		Municipal Cost =	\$8,000 Dollars
		Municipal Savings =	\$0 Dollars

Notes

References

Water Management

Calculation Methodology and Equations

Key Assumptions for Calculations:

Staff time needed for this measure	0.02	Full Time Equivalent (FTE)
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Calculations:

GHG Emission Reduction	Annual GHG emissions reduced =	N/A	MT CO2e
Municipal Costs and Savings Calculations			Staff time needed to time to collaborate with other jurisdictions. Costs of seeking grant funding is business-as-usual.
	FTE =	0.02	Estimated staff time per year
	\$/FTE =	\$100,000	FTE cost per year
	Staff time cost =	\$2,000	Dollars
Municipal Costs and Savings		Municipal Cost =	\$2,000 Dollars
		Municipal Savings =	\$0 Dollars

Notes

References

Infrastructure

Calculation Methodology and Equations

Key Assumptions for Calculations:

Staff time needed for this measure	0.08	Full Time Equivalent (FTE)
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Calculations:

GHG Emission Reduction	Annual GHG emissions reduced =	N/A	MT CO2e
Municipal Costs and Savings Calculations			Staff time needed to time to complete a climate assessment and incorporate climate change consideration in infrastructure planning.
	FTE =	0.08	Estimated staff time per year
	\$/FTE =	\$100,000	FTE cost per year
	Staff time cost =	\$8,000	Dollars
Municipal Costs and Savings		Municipal Cost =	\$8,000 Dollars
		Municipal Savings =	\$0 Dollars

Notes

References

State Measures - Quantification Details

Measure Title	2020 Reduction (MT CO ₂ e)	Assumptions
Clean Car Standards, AB 1493 (Pavley I)	5,891	CARB anticipates that the Pavley I standard will reduce GHG emissions from new California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016. Reductions in GHG emissions from the Pavley I standard were calculated using CARB's EMFAC2011 model for San Luis Obispo County. To account for this standard, EMFAC2011 integrates the reductions into the mobile source emissions portion of its model (CARB, 2011).
Low Carbon Fuel Standard	On-Road: 3,847 Off-Road: 548	The Low Carbon Fuel Standard (LCFS) requires a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. Reductions in GHG emissions from LCFS were calculated using CARB's EMFAC2011 model for San Luis Obispo County. To account for this standard, EMFAC2011 integrates the reductions into the mobile source emissions portion of its model (CARB, 2011).
Title 24	406	The California Energy Commission (CEC) estimates that the 2008 standards reduce consumption by 10 percent for residential buildings and 5 percent for commercial buildings, relative to the previous standards. For projects implemented after January 1, 2014, the CEC estimates that the 2013 Title 24 energy efficiency standards will reduce consumption by 25 percent for residential buildings and 30 percent for commercial buildings, relative to the 2008 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not include other appliances, outdoor lighting that is not attached to buildings, plug loads, or other energy uses. Therefore, these percentage savings were applied to the percentage of energy use covered by Title 24. The calculations and 2020 GHG emissions forecast assume that all growth in the residential and commercial/industrial sectors is from new construction (CEC, 2008; Statewide Energy Efficiency Collaborative, 2011).
Renewable Portfolio Standard	6,248	PG&E must have a renewable portfolio of 33% by 2020. In order to calculate future emissions that take into account the Renewable Portfolio Standard, PG&E's 2020 emissions factor was applied (PG&E, 2011).

Existing Local Measures – Quantification Details

Emissions Category	Measure Title	Detailed Description	Actual Measure or Commitment	2020 Reduction (MTCO ₂ e)	Measure Source	GHG Calculation Methodology Source	Activity Data	Units	Assumptions	Data Sources/Notes
Energy (Community)	Solar Energy Installations (Commercial)	Since 2005, 552 kW of solar photovoltaic and hot water systems have been installed on commercial properties in Arroyo Grande. Many of these installations utilized rebates offered through the California Solar Initiative (CSI), a solar rebate program for California consumers that are customers of the investor-owned utilities, such as PG&E. The CSI program is a key component of the Go Solar California campaign for California. The City of Arroyo Grande also participates in the California FIRST AB 811 Solar and Energy Efficiency Financing Program (for commercial buildings).	552 kW of commercial solar installed	-142	California Solar Initiative	CAPCOA AE-2	1,048,800	kWh	Use 1,900 to convert CEC rating to kWh	Solar Capacity from CA Solar (CEC PTC Rating); Conversion factor from US DOE
Energy (Community)	Solar Energy Installations (Residential)	Since 2005, 956 kW of solar photovoltaic and hot water systems have been installed on residential properties in Arroyo Grande. Many of these installations utilized rebates offered through the California Solar Initiative (CSI), a solar rebate program for California consumers that are customers of the investor-owned utilities, such as PG&E. The CSI program is a key component of the Go Solar California campaign for California. The City of Arroyo Grande also participates in the California FIRST AB 811 Solar and Energy Efficiency Financing Program (for multi-family residential buildings), and	930 kW of residential solar installed plus 26 kW of low-income solar installed as part of SASH = 956 kW total	-247	California Solar Initiative	CAPCOA AE-2	1,816,400	kWh	Use 1,900 to convert CEC rating to kWh	Solar Capacity from CA Solar (CEC PTC Rating); Conversion factor from US DOE

Emissions Category	Measure Title	Detailed Description	Actual Measure or Commitment	2020 Reduction (MTCO ₂ e)	Measure Source	GHG Calculation Methodology Source	Activity Data	Units	Assumptions	Data Sources/Notes
		collaborates with GRID Alternatives on outreach and eligibility to promote the Single-family Affordable Solar Homes (SASH) Program (11 installations were completed in 2010).								
Energy (Municipal)	Energy Efficient Street Lights	38 street lights in Arroyo Grande have been replaced through PG&E's Smart Modernization and Retrofit Technology Solutions program (Note: Streetlights are maintained by PG&E)	20,962 kWh, \$2,552 savings	-3	City memorandum	CAPCOA LE-1	20,962	kWh		
Energy (Municipal)	Municipal Building Energy Efficiency Improvements	The 2010/11 project consisted of 12 heating, ventilation, and air conditioning (HVAC) retrofits including equipment, 15 thermostats, installation of vending machine timers, installation of LCD computer monitors, and installation of computer controls. Installation occurred at all City owned buildings including city council chambers, city hall, fire department, community center, corporate yard, Soto Field complex, and parks and recreation building.	45,749 kwh, 587 therms	-9	City memorandum	CAPCOA BE, LE	45,749 kwh, 587 therms	kWh		
Energy (Municipal)	Municipal Building Energy Efficiency Improvements - Lighting Retrofits	Lighting Retrofits - Lighting upgrades and retrofits at City Hall, City Council Chambers, Farm Credit Bureau, Fire Department, Women's Community Center, and Corporate Yard (approximately 482 energy efficient lights, 28 with fluorescents ballasts and lamps); installation of approximately 12 occupancy	26,010 kWh	-4	City memorandum	CAPCOA LE-1	26,010	kWh		

Emissions Category	Measure Title	Detailed Description	Actual Measure or Commitment	2020 Reduction (MTCO ₂ e)	Measure Source	GHG Calculation Methodology Source	Activity Data	Units	Assumptions	Data Sources/Notes
		sensors.								
Transportation and Land Use	Increase Density and Diversity of Land Use	The City in cooperation with the Chamber of Commerce and area property and business owners will develop a Conceptual Master Plan for the East Grand Avenue corridor. The Conceptual Master Plan should consider adaptive re-use of existing buildings, and identify buildings having characteristics worth preserving and integrating into a coordinated distinctive design motif for each functional segment: Highway Midway and Gateway.	The General Plan calls for targeted increases in density to specific areas within the City, e.g., East Grand Avenue Corridor. Accommodate multiple family housing at a maximum density 25du/ac., FAR of 1.5, and total building height no greater than 35 feet.	Not quantified - included in regional travel demand forecast model	General Plan Land Use Element	CAPCOA LUT-1	8,566	VMT	Already captured in the regional travel demand forecast.	The SLOCOG 2010 travel demand model used to estimate 2005 baseline and 2020 vehicle miles traveled (VMT) is based on year 2009-2011 traffic counts. As such, results for transit and transportation demand management are inherent to the model results. In addition, year 2020 VMT estimates included SLOCOG travel demand forecast model "4-Ds" adjustments for the built environment (land use Density, Design, Diversity, and access to Destinations). Thus, applying additional reductions off-model would double count reductions.

Emissions Category	Measure Title	Detailed Description	Actual Measure or Commitment	2020 Reduction (MTCO ₂ e)	Measure Source	GHG Calculation Methodology Source	Activity Data	Units	Assumptions	Data Sources/Notes
Transportation and Land Use	Increase Density and Diversity of Land Use - mixed use designation	Community commercial, office, residential and other compatible land uses shall be located in Mixed Use (MU) areas and corridors, both north and south of the freeway, in proximity to major arterial streets.	Not quantified - included in regional travel demand forecast model	General Plan Land Use Element	CAPCOA LUT-3		Already captured in the regional travel demand forecast.			The SLOCOG 2010 travel demand model used to estimate 2005 baseline and 2020 vehicle miles traveled (VMT) is based on year 2009-2011 traffic counts. As such, results for transit and transportation demand management are inherent to the model results. In addition, year 2020 VMT estimates included SLOCOG travel demand forecast model "4-Ds" adjustments for the built environment (land use Density, Design, Diversity, and access to Destinations). Thus, applying additional reductions off-model would double count reductions.
Transportation and Land Use	Bicycle and Pedestrian Network Improvements	Bicycle Routes Completed or Under Construction - Elm Street and Fair Oaks Avenue (1.4 miles complete), El Camino Real (1.5 miles, under construction), Castillo Del Mar (0.5 mile, 2012)	3.4 miles of routes completed or under construction	-66	2012 Bicycle and Trails Master Plan	CAPCOA SDT-5	175,589	VMT	Assumes 1% bike mode share. Assumes an average trip length of 20 miles (round trip) and an average of 260 working days per year.	Further implementation of the 2012 Bicycle and Trails Master Plan to be analyzed in the Climate Action Plan.

Emissions Category	Measure Title	Detailed Description	Actual Measure or Commitment	2020 Reduction (MTCO ₂ e)	Measure Source	GHG Calculation Methodology Source	Activity Data	Units	Assumptions	Data Sources/Notes
Transportation and Land Use	Bicycle and Pedestrian Network Improvements	Bicycle and Pedestrian Network Improvements from CIP - The City Capital Improvement Program describes Arroyo Grande's 5-year plan for expenditures. The El Camino Real on Montego street projects will enhance pedestrian and bicycle access.	Montego is one block accessing a school. El Camino is 1.5 miles	-15	City of Arroyo Grande Capital Improvement Program	CAPCOA SDT-1	41,063	VMT	15,000 ADT traffic count	ADT from California Department of Public Health Traffic Volume Linkage Tool
Transportation and Land Use	Reduced Parking near Transit	Municipal Code - Shared parking facilities may be provided in lieu of individual requirements if the total number of parking spaces is the sum of the requirements for individual uses and the parking facilities are located within five hundred (500) feet of the associated use. The total parking requirement may be reduced to eighty (80) percent of the required standard for shared uses; or seventy (70) percent of the required standard for shared uses if a parking study, prepared by a licensed engineer or architect.	Not quantifiable at this time – additional data needed to complete calculation; may be quantified during the toolbox process	Not quantifiable at this time	General Plan Land Use Element and Municipal Code	CAPCOA PDT				Not quantifiable at this time – additional data needed to complete calculation; may be quantified during the toolbox process
Transportation and Land Use	Park and Ride Improvements	Improvements consisted of site grading and drainage, an "all weather surface 250-car capacity parking lot including access drives, parking lane delineation, night lighting and entry-exit signage on about 2.5 acres of the total 5-acre site area		-2	City memorandum, 2012	CAPCOA RPT-4	6,357	VMT	Assumes 97.8% capacity (SLOCOG 2010 RTP). Assumes an average trip length of 20 miles (round trip) and an average of 260 working days per year.	SLOCOG 2010 Regional Transportation Plan
Trees and Other Vegetation	Tree Planting	Planted 250 trees. The City also has a Community Tree Program identified in Section 12.16 of the Municipal Code and conducted an inventory of City maintained street trees, trees in active parks and trees around City owned buildings.	250 trees planted	-3	Implementation measures worksheet	CAPCOA V-1	250	Trees	Assumes annual CO ₂ reduction rate per tree to be 0.0121 (most conservative rate provided in CAPCOA)	CAPCOA V-1. Please note this measure can only account for new trees planted (cannot credit for trees planted as mitigation). Also,

Emissions Category	Measure Title	Detailed Description	Actual Measure or Commitment	2020 Reduction (MTCO ₂ e)	Measure Source	GHG Calculation Methodology Source	Activity Data	Units	Assumptions	Data Sources/Notes
										Community Tree Program and tree inventory support implementation of tree planting, but do not directly result in the planting of trees or a reduction in GHG emissions.
Waste	Construction and Demolition Debris Diversion	As of 2010, the California Green Building Standards Code (CalGreen) requires that 50% of non-hazardous construction and demolition debris be recycled or reused.	50% diversion of construction and demolition debris	-386	California Green Building Standards Code	CAPCOA p. 43; SW-2			According to the California 2008 Statewide Waste Characterization Study, construction and demolition debris makes up 29% of the waste stream and 40% of that is non-hazardous and recyclable.	California 2008 Statewide Waste Characterization Study
Water	Water Conservation Programs to Meet SB 7 Target	Implementation of programs identified in the City's 2010 Urban Water Master Plan to reduce per capita water consumption by 20% consistent with SBx7-7. According to the Plan, this will result in 248,586,535 gallons of water savings by 2020.	248,586,535 gallons of water savings	-43	Urban Water Management Plan	CAPCOA WSW-2	248,586,535	Gallons	Assumes 1,300 kWh/million gallons electricity required to supply, treat, and distribute water.	Urban Water Management Plan (November 2011), CAPCOA WSW-2 (pg. 337), California Energy Commission Refining Estimates of Water-Related Energy Use in California (December 2006)
Other	Green Business Program	Green Business Corridor Program (2009) – economic incentives for “green businesses” along El Camino Real		Not quantifiable – support policy						Does not directly result in a reduction in GHG emissions. Support policy.

APPENDIX C

CAP CONSISTENCY WORKSHEET

CAP Consistency Worksheet

The City of Arroyo Grande CAP was developed to comprehensively analyze and mitigate the significant effects of GHG emissions consistent with CEQA Guidelines Section 15183.5(b) and to support the State's efforts to reduce GHG emissions under Executive Order S-3-05 and AB 32 (see CAP Chapter 1, Sections 1.1 and 1.4). Pursuant to CEQA Guidelines Sections 15064(h)(3) and 15130(d), if a project is consistent and complies with the requirements of an adopted plan, such as a CAP, that includes the attributes specified in CEQA Guidelines Section 15183.5(h), the lead agency may determine that the project's GHG impacts are less than significant with no further analysis required. This appendix sets forth a CAP consistency worksheet that an applicant may use to demonstrate project compliance with the CAP. This checklist should be filled out for each new project, subject to discretionary review of the City of Arroyo Grande.

To determine project consistency and compliance with the CAP, the applicant should complete Sections A and B below, providing project-level details in the space provided. Generally, only projects that are consistent with the General Plan land use designations, and SLOCOG population and employment projections, upon which the GHG emissions modeling and CAP is based, can apply for a determination of consistency with the CAP. In addition, all mandatory actions identified in Section B must be incorporated as binding and enforceable components of the project for it to be found consistent with the CAP. If an action is not applicable to the proposed project, please identify and explain.

At this time, the voluntary actions are not required for project consistency with the CAP; however, if a project does include voluntary actions identified in Section B, project-level details should be described to help the City track implementation of voluntary CAP actions that would contribute to Arroyo Grande's achievement of its GHG emissions reduction target.

If the project cannot meet one or more of the mandatory actions, substitutions (preferably starting with the voluntary actions) may be allowed if the applicant can demonstrate how substituted actions would achieve equivalent reductions to the City's satisfaction. The applicant would also be required to demonstrate that the project would not substantially interfere with implementation of the mandatory CAP actions.

If it is determined that a proposed project is not consistent with the CAP, further analysis would be required and the applicant would be required to demonstrate that the proposed project's GHG emissions fall below the APCD's adopted GHG significance thresholds (see CAP Chapter 1, Section 1.8.3, and **Table 1-2**). The project would also be required to demonstrate that it would not substantially interfere with implementation of the CAP.

APPENDIX C

A. PROJECT INFORMATION

Date:	
Project Name:	
Project Address:	
Project Type:	
Project Size:	
Land Use Designation(s):	
Zoning Designation(s):	
Project Service Population (Residents + Employees):	
Brief Project Description:	
Compliance Checklist Prepared By:	

B. CAP COMPLIANCE WORKSHEET

Measure	Project Actions	Mandatory or Voluntary	Project Compliance (Yes/No/NA)	Details of Compliance*
Energy				
Measure E-5: Incentives for Exceeding Title 24 Energy Efficiency Building Standards	Does the project exceed 2013 Title 24 Building Energy Efficiency Standards?	Voluntary		
Measure E-6: Energy Efficient Public Realm Lighting Requirements	Does the project utilize high efficiency lights in parking lots, streets, and other public areas?	Mandatory		
Measure E-7: Small-Scale On-Site Solar PV Incentive Program	Does the project include installation of solar PV systems and/or solar hot water heaters? If so, what type and how much renewable energy would be generated?	Voluntary		
Measure E-8: Income-Qualified Solar PV Program	Does the project include installation of solar PV systems and/or solar hot water heaters on income-qualified housing units? If so, what type and how much renewable energy would be generated?	Voluntary		
Transportation and Land Use				
Measure TL-1: Bicycle Network	For subdivisions and large developments, does the project incorporate bicycle lanes, routes, and/or shared-use paths into street systems to provide a continuous network of routes, facilitated with markings, signage, and bicycle parking, as currently required by the	Mandatory		

APPENDIX C

Measure	Project Actions	Mandatory or Voluntary	Project Compliance (Yes/No/NA)	Details of Compliance*
	General Plan and Municipal Code?			
	Does the project incorporate bicycle facilities and/or amenities beyond those required?	Voluntary		
Measure TL-2: Pedestrian Network	Does the project provide a pedestrian access network that internally links all uses and connects all existing or planned external streets and pedestrian facilities contiguous with the project site, as currently required by the General Plan and Municipal Code?	Mandatory		
	Does project minimize barriers to pedestrian access and interconnectivity, as currently required by the General Plan and Municipal Code?	Mandatory		
	Does the project implement traffic calming improvements as appropriate (e.g., marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, median islands, mini-circles, tight corner radii, etc.), as currently required by the General Plan and Municipal Code?	Mandatory		
	Does the project incorporate pedestrian facilities and/or amenities beyond those required?	Voluntary		
Measure TL-3: Transit Travel	Does the project provide safe and convenient access to public transit within and/or contiguous to the project area?	Mandatory		

Measure	Project Actions	Mandatory or Voluntary	Project Compliance (Yes/No/NA)	Details of Compliance*
Measure TL-5: Parking Supply Management	Does the project include a reduced number of parking spaces or utilize shared parking?	Voluntary		
Measure TL-6: Electric Vehicle Network and Alternative Fueling Stations	Does the project include the installation of electric or other alternative fueling stations?	Voluntary		
Measure TL-7: Smart Growth	Is the project consistent with the City's land use and zoning code?	Mandatory		
	Does the project include any "smart growth" techniques, such as mixed-use, higher density, and/or infill development near existing or planned transit routes, in existing community centers/downtowns, and/or in other designated areas?	Voluntary		
Off-Road				
O-1: Equipment Upgrades, Retrofits, and Replacements	If the project involves construction or demolition, does equipment utilize low- or zero-emissions vehicles or equipment?	Voluntary		
Tree Planting				
Measure T-1: Tree Planting Program	Does the project include the planting of native and drought-tolerant trees beyond those required as mitigation for tree removal? If so, how many?	Voluntary		

*Please attach additional pages as needed to complete the description and provide project details.